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# Habitat Assessment Manual

# 2017

# Habitat Assessment Manual (HAM) – Introduction

This Habitat Assessment Manual was created as a reference tool for KYTC Environmental Coordinators (ECs) to facilitate timely and efficient documentation of compliance with Section 7 of the Endangered Species Act (ESA). The document is intended to empower ECs, who may not have a background in biology, to assess and document lack of habitat for species that may be considered potentially present within a proposed project area. In conformance with the HAM, such determinations may be made without the involvement of a biology Subject Matter Expert (SME) from the Division of Environmental Analysis (DEA). Making these decisions at the District level promotes more efficient use of limited biology SME resources and more timely completion of required project documentation.

This document provides guidelines for the initial assessment to consider impacts of KYTC projects on federally-listed species or their habitat which is required for compliance with NEPA and Section 7 of the Endangered Species Act (ESA). The assessment may conclude that the project is one that by definition will have No Effect on federally protected species and requires no project-specific documentation (see KYTC/FHWA Determinations of No Effect Memorandum of Understanding, 2005). For other projects, the process will conclude with preparation of a No Effect document or coordination with a DEA SME for further review and analysis. These decisions should be made based on information provided in the HAM, including: photos, Species Description, Habitat Description, Life History Information, Critical Habitat Units, Species Range, Location Maps, and Decision Key. Although the species information provided is not all inclusive, it should be sufficient for determining further actions required in most KYTC project circumstances.

## Organization of HAM

The HAM is divided into groupings which separate organisms (e.g. – birds, crustaceans, fishes, mammals, etc.). A 'Notable Species' section also details species with ESA history, but which are not currently provided any federal protections (e.g. delisted, not warranted, etc.) and thus formal review or actions are not required. Within each grouping, species are arranged in alphabetical order by common name. In most cases, each species section can be considered a standalone document; however, further useful general information may also be provided in grouping level documents such as the introduction, glossary, figures, or literature cited (e.g. fish, bats, mussels).

## Species Information

Information presented for individual species will typically include photos, Species Description, Habitat Description, Life History Information, Critical Habitat Units, Species Range, Location Maps, and Decision Key. For species with designated critical habitat units, the primary constituent elements that were listed in the Federal Register by the US Fish and Wildlife Service (USFWS) are provided. Other critical habitat information may include a table of listed units, unit descriptions, and/or maps of each unit location.

USFWS has a new record sharing method via their online IPaC (Information for Planning and Conservation) tool. ***IPaC is now the required method for securing an official species list from our USFWS-Kentucky Field Office.*** IPaC can be accessed at the following interactive website: ***https://ecos.fws.gov/ipac/***. See further guidance detail in No Effects Determination Step 1 below, or assistance in use of this website can be provided by contacting your DEA SME Biologist.

Kentucky State Nature Preserves Commission (KSNPC), and Kentucky Department of Fish and Wildlife Resources (KDFWR) also keep and maintain records for federally listed species and other species of concern (e.g. state listed). KSNPC and KDFWR records are available via formal consultation request (email or letter) and may require a small fee. Dependent on level of review, coordination with these agencies is highly suggested for obtaining useful, detailed species records at/near your project area. KSNPC records are often detailed beyond the USFWS official species list generated.

## How to Use the HAM

To address Section 7 of the Endangered Species Act, start with identifying which species are listed for the project's area or at the county level (refer to Species Information section above), and then perform a Habitat Assessment (HA) using the information in this HAM. Conditions in the project vicinity should be compared to the habitat requirements described in the HAM for each listed species with potential to occur within that particular area or county. Based on this comparison and working through the questions in the provided Decision Key, you will make a determination on how to address each listed species or whether you need to contact your SME for additional review. The assessment may conclude that the project is one that by definition will have No Effect on federally protected species and requires no project-specific documentation (see KYTC/FHWA Determinations of No Effect Memorandum of Understanding, 2005). For other projects, the process will conclude with preparation of a No Effect document or coordination with a DEA SME for further review and analysis. The SME may determine that there is No Effect or require a Biological Assessment for certain listed species (this may require seasonal survey efforts). Each of these options are discussed in further detail below.

## Project Types Defined as Having No Effect

The following fifteen categories are considered to have *No Effect by Definition* (see KYTC/FHWA Determinations of No Effect Memorandum of Understanding, 2005) to federally listed species. The list closely aligns with the Categorical Exclusion (CE) list for undocumented CEs (the "C" list") that was in FHWA regulation in 2005. Though the "C" list has been significantly expanded in recent years, the projects defined as having No Effect by definition has not changed. Regardless of whether listed species may be present within the vicinity of these project areas, it is highly unlikely that the species, habitat, or critical habitat as defined in the HAM would be affected due to the location and nature of these project types. If your project fits into one or more of the fifteen categories listed below, no project-specific documentation is required.

**If a project included in the list below involves removal or impact to suitable listed species habitat as defined in the HAM (e.g. tree removal) or if the project includes any additional activities that do not fully fit into any of the fifteen categories described below, then you must continue with a No Effect finding or consult your SME.**

No Effect Projects by Definition*:

1) General highway maintenance, including filling potholes, crack sealing, mill and resurfacing, joint grinding/milling, etc.
2) Guardrail replacement where no new bank stabilization is required.
3) The replacement of traffic signals within existing ROW.
4) The installation or maintenance of signs or pavement markings within the existing ROW.
5) General pavement marking or "line painting" projects.
6) The installation of raised pavement markers.
7) Mowing or brush removal/trimming projects within existing ROW.
8) Improvements to existing KYTC/County maintenance facilities.
9) Study-type projects (e.g. feasibility studies, etc.).
10) Installation of new fencing, signs, small passenger shelters, traffic signals, or railroad warning devices where no habitat, as defined in the HAM, occurs.
11) Acquisition of scenic easements.
12) Transfer of federal lands pursuant to USC 317 when the subsequent action is not an FHWA action.
13) Track and rail-bed improvements, maintenance activities, or acquisition.
14) Bridge deck overlays, bridge deck replacements and other maintenance activities, including painting projects provided the project does not involve any work within or involve impacts to streams, rivers, scenic river corridors, or other habitat as defined in the HAM.
15) Disposal of excess ROW parcels wholly contained in recent Major Project Acquisitions.

*List is derived from KYTC/FHWA Determinations of No Effect Memorandum of Understanding, 2005. Contact your SME Biologist if you would like a copy of the full MOU document.

## No Effect Determination

Projects not 'defined' as having No Effect, as described in the previous section will instead need to be evaluated on a project-by-project basis. A No Effect determination can be reached if (1) the habitat requirements of a potentially occurring listed species are not present in the project's impacts area, or (2) if listed species potential habitat is in the project vicinity but that habitat will not be impacted by the proposed actions.

*Note: Always consult with SME Biologist for work in or adjacent to critical habitat units.*

Below are steps that are appropriate steps to be followed to reach a No Effect determination.

**Step 1.** Identify which species are federally listed for either the specific area or the entire county where the KYTC project is located by using USFWS's IPaC interactive website (https://ecos.fws.gov/ipac/). Drawing your specific project area within IPaC can aid in pinpointing your project area's potential for containing habitat for federally listed species. Obtaining your species list at the county level is also still accurate; however, may include a large list of species, all of which must then be discussed and evaluated in your documentation. If there is any uncertainty regarding this list, please consult with your DEA SME Biologist.

**Step 2.** Once all listed species have been identified for a project area (including excess material sites), review each species' section in the HAM for further evaluation. Identify the types of habitat used by the various species in question and assess, by gathering appropriate office or field data, whether a species' habitat may or may not be present within the project area. Where a project area coincides or is in proximity to areas of designated critical habitat, the EC must coordinate with the DEA SME Biologist.

**Step 3.** Answer the questions of each Decision Key to identify steps necessary for determining and documenting the environmental habitat assessment for each listed species. Some species may have a longer Decision Key than others and require multiple

steps. Recognize that some questions may be answered based on office review alone, while other instances may require a site visit for field assessment.

Most Decision Keys begin with an office assessment component that requires either a 'yes' or 'no' answer. These office assessments may include identifying presence/absence of features such as perennial streams, trees, sinkhole/karst potential, etc. Review of area conditions such as stream order, topographical features, soil type, and/or other physical or geologic features may also be pertinent.

**Step 4.** If no habitat is present for listed species, or suitable habitat will not be impacted by the project, then complete a No Effect document. The No Effect document must include species habitat descriptions (provided within the HAM) to compare habitat present at the project site and habitat characteristics required for the listed species. This results section should clearly describe why or how it was determined that the required species' habitat was unsuitable or absent from the project area or how suitable habitat will not be impacted.

**If a project cannot be fully reported via No Effect finding, you must consult your SME.**

## Contact DEA SME Biologist

For projects that are not 'defined' as having No Effect and where a determination of No Effect cannot be reached through the Decision Key (see Step 3 above), the project must be reviewed by a DEA SME Biologist. After working through Steps 1-3 above, if it is found that suitable listed species habitat may be present and is likely to be impacted, then **Step 4** (instead of a No Effect document) will be to contact the DEA SME Biologist. This will be determined when a species' Decision Key concludes SME review as the necessary action. Inevitably, some projects will require further assessment by the SME Biologist such as a site visit or seasonal field survey. The first step in this further assessment is for the EC to provide the SME with a Request for Assistance, including the project location (including excess material sites), description (i.e. proposed action, purpose and need), plan set (PDF/DGN), maps, photos, desired schedule for completion of work and any other pertinent information available.

The SME will usually conduct an on-site habitat assessment after their initial office review. Once their review is complete, the SME will determine how best to proceed to provide compliance with Section 7 of the ESA. These actions may include use of Programmatic Agreements, field surveys, Biological Assessment reports, Biological Opinions, etc. When the EC sends a Request for Assistance to their SME Biologist, they should also consider the seasonal requirements for identification of many species and afford sufficient time for the SME to complete any necessary review or actions (e.g. surveys) prior to a project's letting date or upcoming action (ROW authorization, utility relocation, etc.). See project example below:

> **Example:** A proposed project is located on the western edge of Morgan County. The project is a reconstruction of an existing state road. According to the project-specific official species list generated via IPaC, it is determined that snuffbox mussel, Indiana bat, gray bat, northern long-eared bat, and Virginia big-eared bat are currently listed for Morgan County. After reviewing the HAM species information for snuffbox mussel, it is determined that there are no "perennial streams or their nearby tributaries" located within the project area. By following the Decision Key, due to this lack of habitat, the snuffbox mussel would qualify for inclusion within a KYTC 'No Effect' document. It is determined that tree take will occur for the project, and that blasting impacts are expected. Some karst areas are nearby, and the project is in known bat swarming habitat (which would indicate known caves in the project's vicinity). Based on the potential for cave/portal habitat surrounding the project, and the known take of summer roosting habitat (trees), the EC would then contact DEA SME Biologist to provide advanced project review and assessment.

# Migratory Bird Treaty Act (1918)

The Migratory Bird Treaty Act (MBTA) is a Federal law that prohibits (individual, entity, or agency) the taking of any kind (killing, capturing, nest removal, egg collection, possess, sell, trade, purchase, deliver, import, export, transport, etc) of any migratory bird. The latest list of over 2100 species, roughly 800 occurring in North America, can be found at the USFWS webpage: https://www.fws.gov/migratorybirds/RegulationsPolicies/mbta/mbtandx.html**.** Instances in which the MBTA does not apply occur under special circumstances approved by the MBTA: specific species hunting seasons for specific regions, nuisance/non-native exotic species, and other special circumstances. In short, it is unlawful to take, all inclusive definition, any protected migratory bird from the above referenced list.

How does this apply to KYTC? Most of our actions do not include what KYTC considers take. Only in a few instances, where eagles, hawks (osprey), owls, or other large birds actively nest on bridges or within the project zone, have we been required to coordinate with USFWS (via KDFWR) to comply with the MBTA. If you suspect concerns with take or harassment of any bird species protected under the MBTA, please contact your SME for further investigation.

# Fixing America's Surface Transportation Act (FAST Act)

Under the FAST Act, the take of active swallow nests on qualifying bridges [with any component condition rating of 3 or less (as defined by the National Bridge Inventory General Condition Guidance issued by the Federal Highway Administration)] is authorized during the typical breeding season of April 1 through August 31. This is due to the frequency in which bridges provide ideal artificial nesting habitat for some swallow species and to ensure public transportation safety. This Act permits take for nests of all swallow species (Table 1); however, the majority of those found on bridges are utilized by cliff swallows and barn swallows (Images 1 and 2). The following excerpt from the FAST Act explains protocol and requirements for breeding season take of active swallow nests. All inactive nests may be removed after verification of inactivity during the breeding season. Coordination is not required for bridge activities scheduled during the non-breeding season of September 1 through March 31.
All coordination for the FAST Act will be completed via assistance from a DEA SME Biologist.
Link to full FAST Act: https://www.gpo.gov/fdsys/pkg/PLAW-114publ94/pdf/PLAW-114publ94.pdf

Image 1: Cliff Swallow and typical nests

Image 2: Barn Swallow and typical nest

Table 1: Breeding swallow species of Kentucky

| Common Name | Scientific Name | Nesting Habitat |
|---|---|---|
| Tree Swallow | *Tachycineta bicolor* | Tree cavities/bird houses in open fields or over water |
| Bank Swallow | *Riparia riparia* | -Colonial<br>Excavates tunnels into vertical sandbanks |
| Northern Rough-winged Swallow | *Stelgidopteryx serripennis* | Holes in sandbanks, crevices, pipes in cliffs/walls |
| Cliff Swallow | *Petrochelidon pyrrhonota* | -Colonial<br>Overhanging ledges of rocky cliffs, building eaves, **bridges** |
| Barn Swallow | *Hirundo rustica* | Cliff ledges, house eaves, **bridges** |
| Purple Martin | *Progne subis* | Tree cavities/martin houses in open fields or over water |

FAST Act Excerpt concerning swallow nest take:

**SEC. 1439. ELIMINATION OF BARRIERS TO IMPROVE AT-RISK BRIDGES.**

(a) TEMPORARY AUTHORIZATION—

(1) IN GENERAL.—Until the Secretary of the Interior takes the action described in subsection (b), the take of nesting swallows to facilitate a construction project on a bridge eligible for funding under title 23, United States Code, **with any component condition rating of 3 or less** (as defined by the National Bridge Inventory General Condition Guidance issued by the Federal Highway Administration) is authorized under the Migratory Bird Treaty Act (16 U.S.C. 703 et seq.) between April 1 and August 31.

(2) MEASURES TO MINIMIZE IMPACTS.—

(A) NOTIFICATION BEFORE TAKING.—Prior to the taking of nesting swallows authorized under paragraph (1), any person taking that action shall submit to the Secretary of the Interior a document that contains—

(i) the name of the person acting under the authority of paragraph (1) to take nesting swallows;

(ii) a list of practicable measures that will be undertaken to minimize or mitigate significant adverse impacts on the population of that species;

(iii) the time period during which activities will be carried out that will result in the taking of that species; . . and

(iv) an estimate of the number of birds, by species, to be taken in the proposed action.

(B) NOTIFICATION AFTER TAKING.—Not later than 60 days after the taking of nesting swallows authorized under paragraph (1), any person taking that action shall submit to the Secretary of the Interior a document that contains the number of birds, by species, taken in the action.

(b) AUTHORIZATION OF TAKE.—

(1) IN GENERAL.—The Secretary of the Interior, in consultation with the Secretary, shall promulgate a regulation under the authority of section 3 of the Migratory Bird Treaty Act

(16 U.S.C. 704) authorizing the take of nesting swallows to facilitate bridge repair, maintenance, or construction—

(A) without individual permit requirements; and

(B) under terms and conditions determined to be consistent with treaties relating to migratory birds that -----` protect swallow species occurring in the United States.

(2) TERMINATION - On the effective date of a final rule under this subsection by the Secretary of the Interior, subsection (a) shall have no force or effect.

(c) SUSPENSION OR WITHDRAWAL OF TAKE AUTHORIZATION.— If the Secretary of the Interior, in consultation with the Secretary, determines that taking of nesting swallows carried out under the authority provided in subsection (a)(1) is having a significant adverse impact on swallow populations, the Secretary of the Interior may suspend that authority through publication in the Federal Register.

# Golden and Bald Eagle Protection Act (1940)

The Bald and Golden Eagle Protection Act prohibits anyone, without a permit issued by the Secretary of the Interior, from taking bald eagles (or golden eagles), including their parts, nests, or eggs. The Act provides criminal penalties for persons who "take, possess, sell, purchase, barter, offer to sell, purchase or barter, transport, export or import, at any time or any manner, any bald eagle ... alive or dead, or any part, nest, or egg thereof." The Act defines "take" as "pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest or disturb." "Disturb" means: “to agitate or bother a bald or golden eagle to a degree that causes, or is likely to cause, based on the best scientific information available, 1) injury to an eagle, 2) a decrease in its productivity, by substantially interfering with normal breeding, feeding, or sheltering behavior, or 3) nest abandonment, by substantially interfering with normal breeding, feeding, or sheltering behavior."

In addition to immediate impacts, this definition also covers impacts that result from human-induced alterations initiated around a previously used nest site during a time when eagles are not present, if, upon the eagle's return, such alterations agitate or bother an eagle to a degree that interferes with or interrupts normal breeding, feeding, or sheltering habits, and causes injury, death or nest abandonment.

A violation of the Act can result in a fine of $100,000 ($200,000 for organizations), imprisonment for one year, or both, for a first offense. Penalties increase substantially for additional offenses, and a second violation of this Act is a felony.

Link to full Bald and Golden Eagle Protection Act: http://www.fws.gov/permits/ltr/ltr.html.
Bald and Golden Eagle Act Permit Regulations: Code of the Federal Register 50 Part 22

## Literature Cited:

USFWS Website http://www.fws.gov/midwest/midwestbird/eaglepermits/bagepa.html).

# Bald Eagle

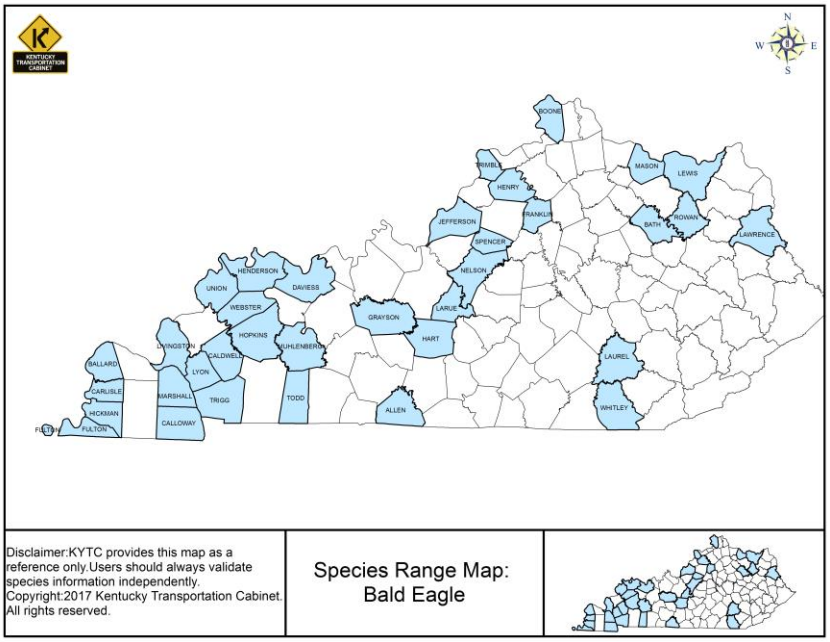

## Species Description

This state and national iconic symbol has become a champion of the Endangered Species Act because it was **delisted** due to recovery. This raptor is characterized with seven foot wingspans, with mature adults possessing "bald" white heads and tails. Juveniles and immatures, although overall dark or black, have some variation or mottling of white and black among the plumage. In the field they can typically be distinguished by their size and flight pattern (straight to slightly over-arched wingspan in comparison to a Turkey Vultures dihedral shape or the stout and wings and short tail of Black Vultures).

## Habitat and Range

Typically Bald Eagles are associated with large bodies of water. Kentucky has several lakes and large rivers that potentially provide habitat for these birds. Although adept at hunting and fishing, Bald Eagles are also skilled thieves of other birds of prey, and can often be observed stealing food from Osprey and other raptors.

The map provided shows where agencies (KDWFR, KSNPC, USFWS) currently list Bald Eagles. However, if a project is near a large body of water like a lake, the Ohio River, Mississippi River, and other large Rivers, then attention to potential presence detection is warranted.



# Least Tern (*Sterna antillarum*)

## Species Description


Photo Credit: http://www.allaboutbirds.org

The interior population of Least Tern was listed as **endangered** in 1985.

Least Terns are the smallest member of the tern sub-family, measuring 7–9 inches length with a 19–20 inch wingspan. Though plumages may vary, adults during breeding season have a black cap with a white forehead, and yellow bills with a black tip. Backs are light gray, and the underbelly is white.

## Habitat Description

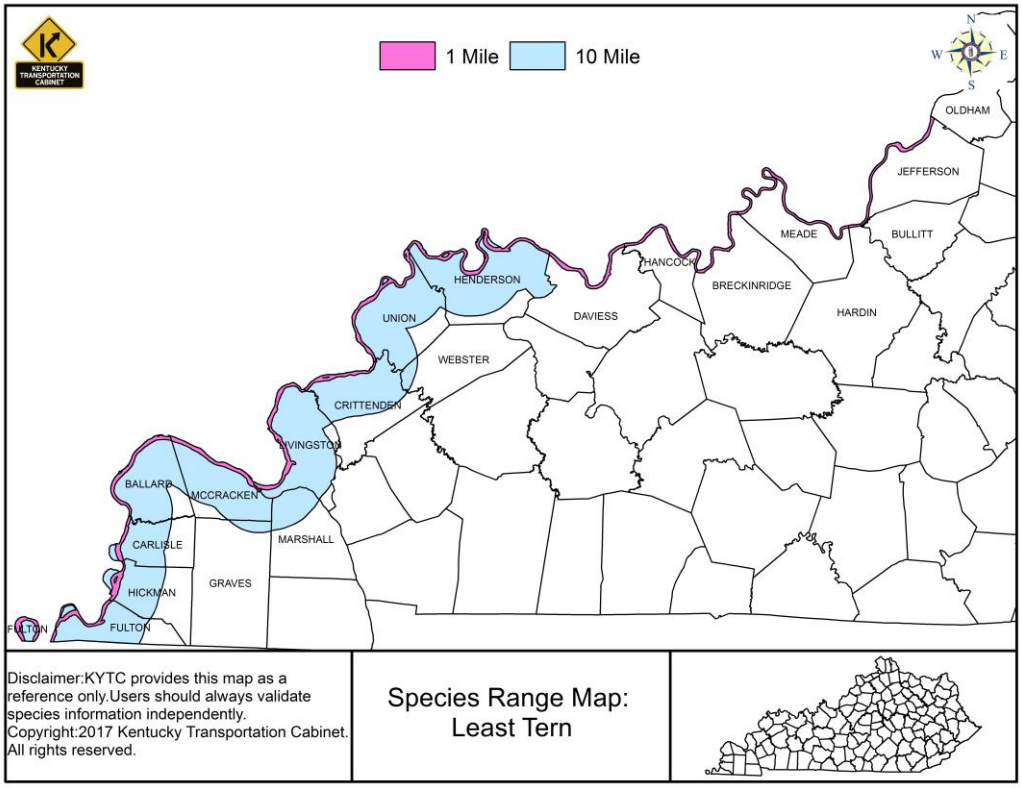
Least Terns prefer sea coasts, beaches, bays, estuaries, lagoons, lakes and (for KY) rivers. Biological and ecological factors dictate breeding grounds for the Least Tern: they require a presence of bare or nearly bare alluvial islands or sandbars coupled with favorable water levels during nesting seasons.

## Critical Habitat

None

## Range

The interior population of the Least Tern historically extended across central North America, but is now generally restricted to less altered and disturbed river segments of the Ohio, Mississippi, Missouri, Red, and Rio Grande River Systems.




## Decision Key

1) Does the project have any direct or indirect impacts within 1 mile of the Mississippi or Ohio River from Jefferson to Fulton Counties, or within 10 miles of the Mississippi or Ohio River from Henderson to Fulton Counties?

    a. Yes: Contact SME
    b. No: Prepare NE finding

## References

U.S. Fish and Wildlife Service. 1985. Interior Population of Least Tern to be Endangered, Final Rule. *Federal Register* 50: 21784-21792.

Thompson, Bruce C., J.A. Jackson, J. Burger, L.A. Hill, E. M. Kirsh, and J.L. Atwood. Least Tern. Birds of North America Online. Issue 290. http://bna.birds.cornell.edu/bna/species/290/articles/introduction.

# Big Sandy Crayfish (*Cambarus callainus*)

## Species Description

Big Sandy crayfish was listed as **endangered** on May 9, 2016.


Big Sandy Crayfish *(Cambarus callainus)*. Credit: Zachary Loughman, West Liberty University

The Big Sandy crayfish is a freshwater, tertiary burrowing crustacean of the Cambaridae family. Tertiary burrowing crayfish do not exhibit complex burrowing behavior; instead, they shelter in shallow excavations under loose cobbles and boulders on the stream bottom. The Big Sandy crayfish is closely related to the Guyandotte River (*C. veteranus*) crayfish and both species share many basic physical characteristics. Adult body lengths range from 3.0 to 4.0 inches, and the cephalothorax (main body section) is streamlined and elongate, and has two well-defined cervical spines. The elongate convergent rostrum (the beak-like shell extension located between the crayfish's eyes) lacks spines or tubercles (bumps). The gonopods (modified legs used for reproductive purposes) of Form I males (those in the breeding stage) are bent 90 degrees to the gonopod shaft. Diagnostic characteristics that distinguish the Big Sandy crayfish from the Guyandotte River crayfish include the former's narrower, more elongate rostrum; narrower, more elongate chelea (claw); and lack of a well-pronounced lateral impression at the base of the claw's immovable finger. Carapace (shell) coloration ranges from olive brown to light green, and the cervical groove is outlined in light blue, aqua, or turquoise. The rostral margins and post orbital (behind the eye) ridges are crimson red. The abdominal terga (dorsal plates covering the crayfish's abdomen) range from olive brown to light brown to light green and are outlined in red. The walking legs of the Big Sandy crayfish range from light green to green blue to green, and the chelae are usually aqua but sometimes green blue to blue. This species likely functions as an opportunistic omnivore, with seasonal-mediated tendencies for animal or plant material.

The general life cycle pattern of the species is 2 to 3 years of growth, maturation in the third year, and first mating in midsummer of the third or fourth year. Following midsummer mating, the annual cycle involves egg laying in late summer or fall, spring release of young, and late spring/early summer molting. The likely lifespan is thought to be 5 to 7 years, with the possibility of some individuals reaching 10 years of age.

## Habitat Description

Suitable instream habitat is generally described as clean, third order or larger (width of 4 to 20 meters), fast-flowing, permanent streams and rivers with unembedded slab boulders on bedrock, cobble, or sand substrate.

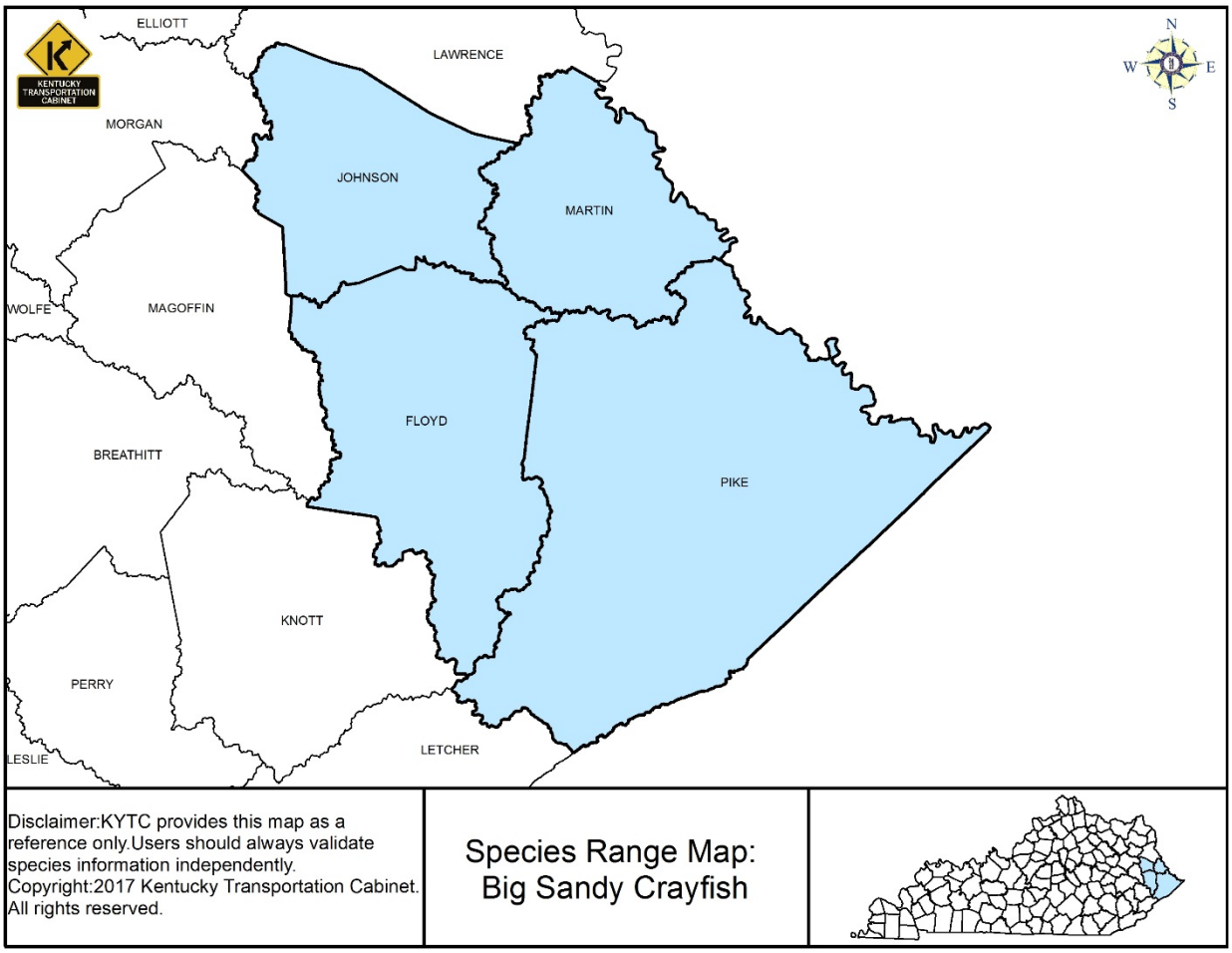
Under natural (i.e., undegraded) conditions, this habitat was common in streams throughout the entire upper Big Sandy watershed, and historically this species likely occurred throughout the range where this undegraded habitat existed. However, by the late 1800s, commercial logging and coal mining coupled with rapid human population growth and increased development in the narrow valley riparian zones, began to severely degrade the aquatic habitat throughout the river basin. Based on the best available data, it is assumed that the widespread habitat degradation, most visible as stream bottom embeddedness, likely led to this specie's decline and the eventual extirpation of the Big Sandy crayfish from many streams within their historical range. Big Sandy crayfish appears to be intolerant of excessive sedimentation and embeddedness of the stream bottom substrate. This statement is based on observed habitat characteristics from sites that either formerly supported the Big Sandy crayfish or from sites within the species' historical range that were predicted to be suitable for the species, but where neither of the species (and in some cases no crayfish from any species) were observed.

## Critical Habitat

None at this time but through correspondence with the USFWS Frankfort Field Office it can be assumed the Russell Fork and Elkhorn Creek will eventually be proposed as critical habitat for this species.

## Range

Big Sandy crayfish is endemic to Kentucky and is known within the Big Sandy River watershed. Based on direct coordination with the USFWS Kentucky Field Office, our assessments will focus on the following 4 counties; Pike, Floyd, Martin, and Johnson.



## Decision Key

1) Does the project area lie within the Big Sandy river watershed within Pike, Martin, Johnson or Floyd Counties?

    a. Yes: Go to #2
    b. No: Prepare NE finding.

2) Will the project be directly or indirectly impacting a 3rd order or larger stream?

    a. Yes: Go to #3
    b. No: Prepare NE finding

3) Does the project directly or indirectly affect the Russell Fork?

    a. Yes: Contact SME.
    b. No: Go to #4

4) Does the stream being impacted have a substrate that includes unembedded large rock/slab boulders?

    a. Yes: Contact SME
    b. No: Prepare NE finding.

## Literature Cited

Loughman, Z.J. 2013. Rediscovery of *Cambarus veteranus* (Big Sandy Crayfish) in West Virginia with a discussion of future conservation needs within the state. Report submitted to the West Virginia Division of Natural Resources and the United States and Wildlife Elkins, West Virginia Field Office. 17 pp.

Loughman, Z.J. 2014. Biological status review of *Cambarus veteranus*. Final report prepared for United States Fish and Wildlife Service. 49 pp.

Thoma, R.F.; Z.J. Loughman; J.W. Fetzner, Jr. 2014. "*Cambarus (Puncticambarus) callainus*, a new species of crayfish (Decapoda: Cambaridae) from the Big Sandy River basin in Kentucky, Virginia, and West Virginia, USA".

Thoma, R.F. 2009. The conservation status of *Cambarus* (*Puncticambarus*) *veteranus*, Big Sandy Crayfish; *Cambarus* (*Jugicambarus*) *jezerinaci*. Spiny Scale Crayfish and *Cambarus* (Cambarus) sp. A, Blue Ridge Crayfish. MBI Technical Report MBI/2009-6-1 June 25. 2009.

Thoma, R.F. 2010. The conservation status of *Cambarus* (*Puncticambarus*) *veteranus*, Big Sandy Crayfish and *Cambarus* (*Jugicambarus*) *parvoculus*. Mountain Midget Crayfish in Kentucky. MBI Technical Report MBI/2010 May 25, 2010.

Loughman, Z.J. 2015a. Cambarus callainus range wide conservation status survey. Report prepared for the U.S. Fish and Wildlife Service. pp. 29, 41–43.

Loughman, Z.J. 2015b. Cambarus callainus range wide conservation status survey. Report prepared for the U.S. Fish and Wildlife Service. pp. 28–30

# Kentucky Cave Shrimp (*Palaemonias ganteri*)

AKA: Mammoth Cave Shrimp

## Species Description

Kentucky Cave Shrimp (*Palaemonias ganteri*) was listed as an **endangered** species October 12, 1983.

Once thought to have been extinct, the Kentucky cave shrimp is a fresh-water shrimp and member of the *Atyidae* family. Kentucky cave shrimp have reduced eyes and lack body pigmentation, which is common for species with a history of subterranean existence. They can reach a maximum total length of 30 mm (1.2 inches). Kentucky cave shrimp graze the surface of sediments and consume a diet of mainly protozoan, algal cells, fungi, and other organic materials.


Some of the life history of Kentucky cave shrimp is relatively unknown. Female shrimp have been observed carrying their clutch of eggs (up to 33) under their abdomen throughout all seasons of the year. These observations suggest that reproduction is continual (rather than seasonal). It is uncertain whether a female shrimp can reproduce more than once in its life time. Aquarium studies have estimated Kentucky cave shrimp life spans to be between 10 and 15 years.

## Habitat Description

Kentucky cave shrimp prefers habitats within the large, base level passages of cave systems that provide slow flow, abundant organic matter, and coarse to fine grain sand and coarse silt sediment. Preferred habitat areas also contain quiet, silt-bottom pools exposed to seasonal flooding conditions.

Human-related activities that cause groundwater contamination can be threats to Kentucky cave shrimp habitat. Such activities may include random traffic accidents, oil and gas activities, agriculture, permitted discharge from industry/wastewater treatment plants/etc., release of sediment/siltation, and general non-point sources. Due to the karst systems present within the Mammoth Cave area, pollutants can quickly enter and travel throughout a groundwater basin through features such as sinkholes, sinking streams, and other karst features. These pollutants, including pesticides, could have adverse affects on Kentucky cave shrimp populations located downstream, so it is important to protect the integrity of these 'recharge basins'.

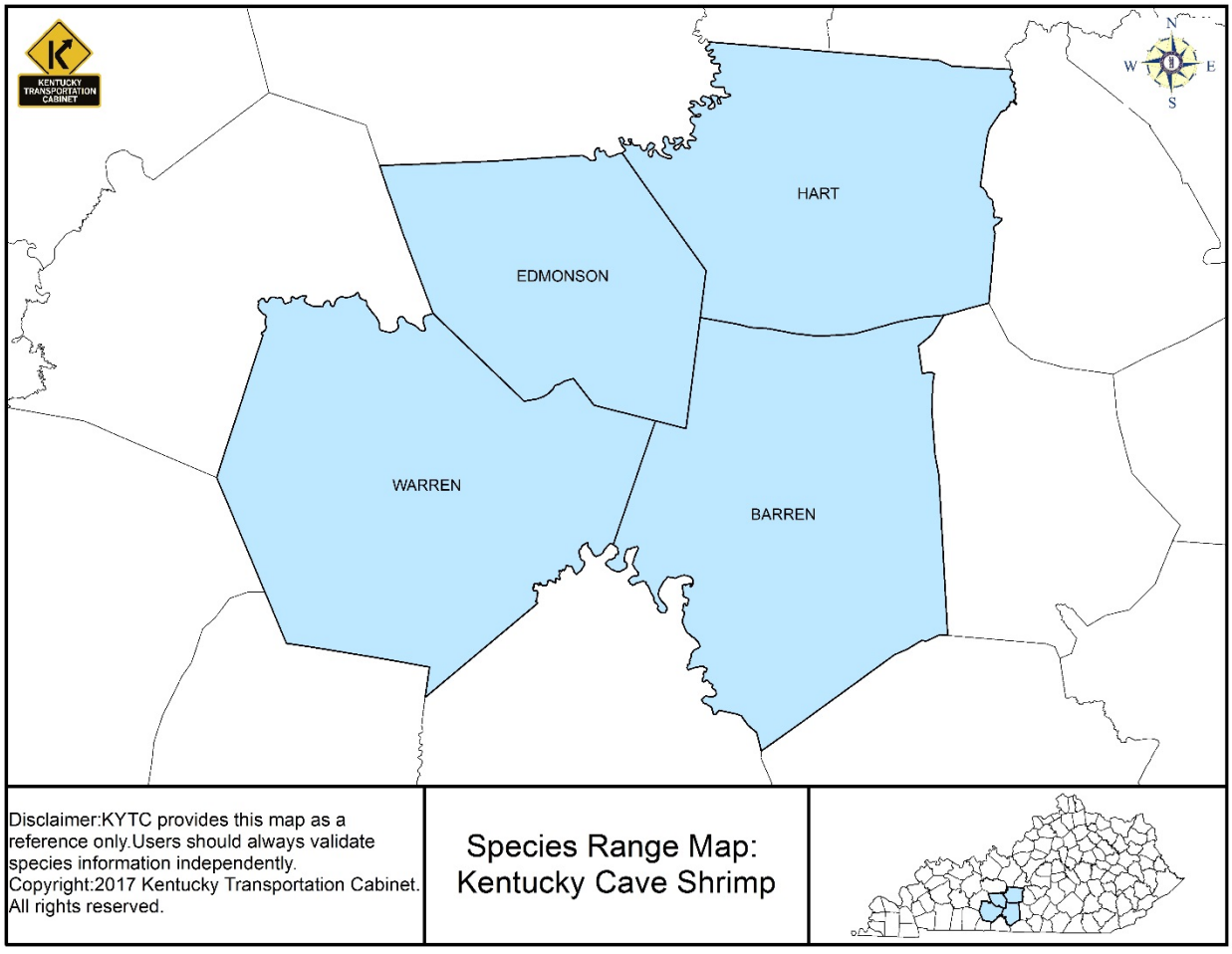
## Critical Habitat

Yes

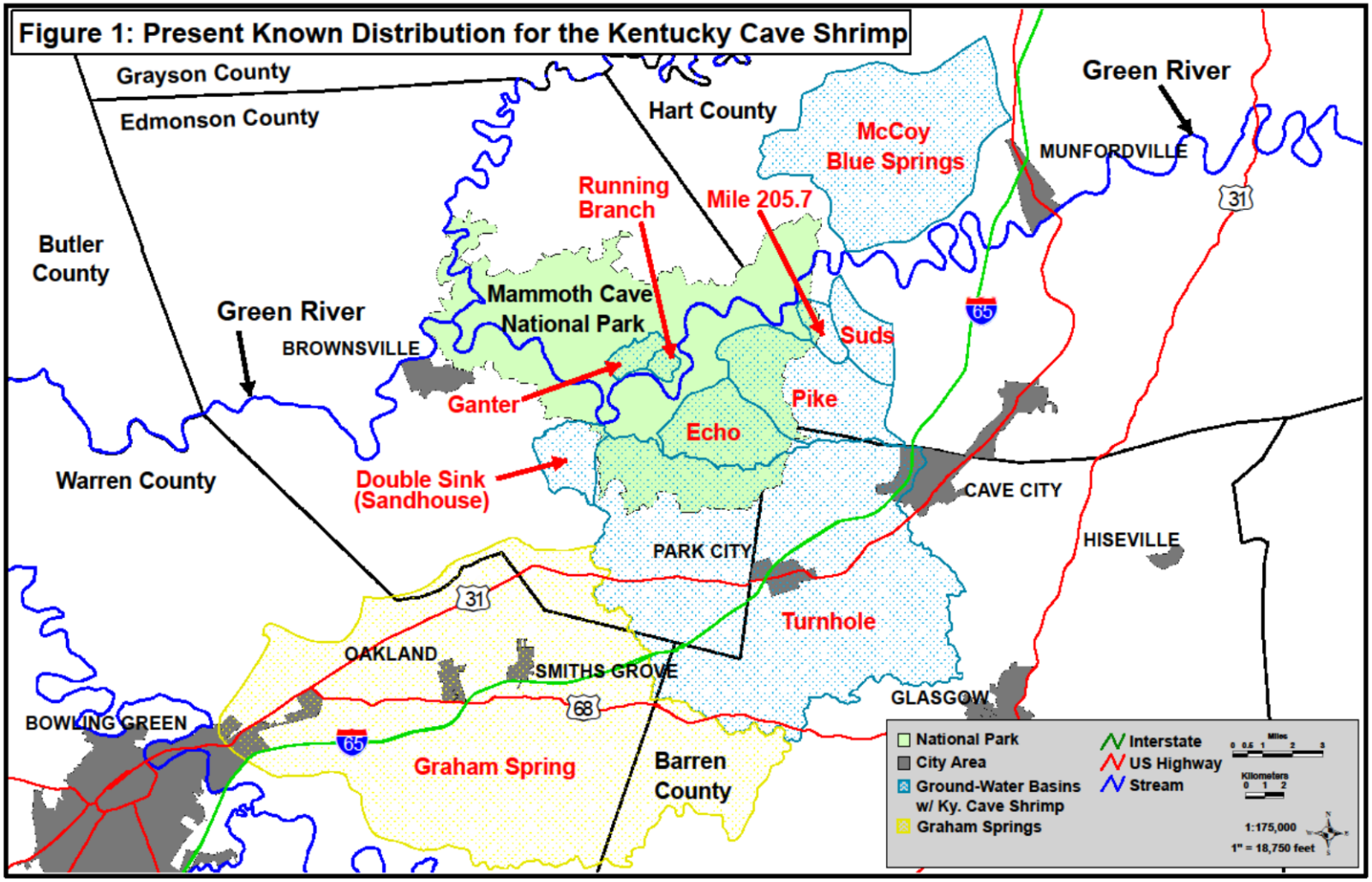
Approximately one- mile of the Roaring River Passage in the Mammoth Cave National Park was designated as critical habitat on October 12, 1983 at the same time the species was listed as endangered. No additional critical habitats have been designated since that date.

## Range

The Kentucky cave shrimp is endemic to the Mammoth Cave National Park region of west-central Kentucky. The species occurs in cave systems on both the north and south sides of the Green River, primarily within the Park boundaries. There are known populations outside of the Park; however, the surface/underground watersheds that feed most of the caves that contain these endangered shrimp extend well beyond the Park boundaries. The current known distribution includes nine distinct groundwater basins in the Mammoth Cave region including: Echo River Spring, Ganter Spring, Running Branch Spring, Mile 205.7 Spring, Pike Spring, Double Sink (Sandhouse Cave), Turnhole Spring, McCoy Blue Spring, and Suds Spring (Figure 1). Although unconfirmed, Graham Springs Basin and Hidden River Cave may also be areas of potential Kentucky cave shrimp habitat. Currently, this species is listed for four counties in west-central Kentucky.



The following map (Figure 1) was provided to KYTC by USFWS (Mike Floyd, personal communication) in January 2014 representing ground-water basins and areas of Kentucky cave shrimp habitat distribution within Kentucky.



## Decision Key

**Note: This assessment is best determined from office resources due to the availability of dye-tracing research (GIS shapefiles available). Please use map provided in Figure 1 to help determine if a project area occurs within the boundaries of a recharge basin.**

5) Does the project area lie partially or totally within, or have any direct or indirect effects to a Kentucky cave shrimp recharge basin?

    a. Yes: Contact SME
    b. No: Prepare NE finding.

## References

U.S. Fish and Wildlife Service. 1980. Endangered and Threatened Wildlife and Plants; Proposed Endangered Status and Critical Habitat for the Kentucky Cave Shrimp. 45 FR 68975-68978.

U.S. Fish and Wildlife Service. 1988. Kentucky cave shrimp recovery plan. Atlanta, Georgia. 47 pp.

U.S. Fish and Wildlife Service. 2007. Kentucky cave shrimp (Palaemonias ganteri); 5-Year Review: Summary and Evaluation. Southeast Region, Kentucky Ecological Services Field Office. Frankfort, Kentucky.

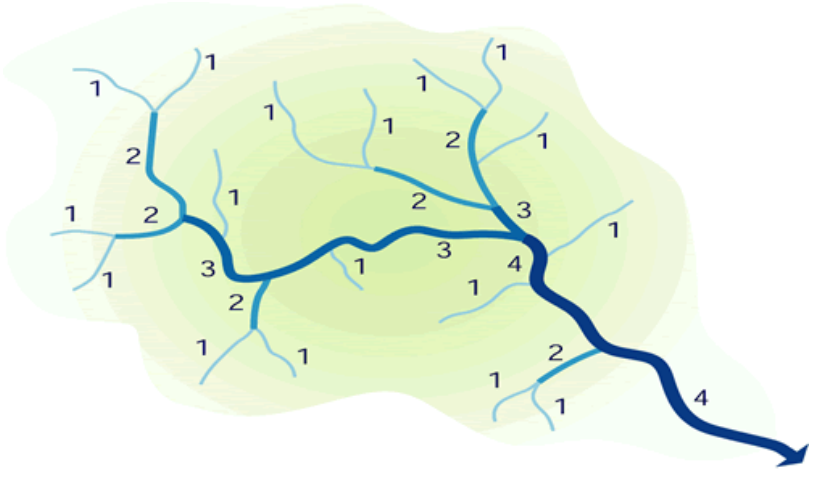
# Basic Introduction to Fish and Watersheds

A river basin is defined as the land area drained by a river and its tributaries. These boundaries are naturally existent due to topography changes in an area. The state of Kentucky contains 13 major river basins: Big Sandy, Green, Kentucky, Licking, Little Sandy, Lower Cumberland, Mississippi, Ohio, Salt, Tennessee, Tradewater, Tygarts, and Upper Cumberland.

These 13 river basins are further divided into many smaller watersheds. A watershed is a network of smaller rivers or streams and their tributaries. A watershed can drain or seep into a marsh, stream, river, lake, or groundwater. Often watersheds are characterized by their drainage size and classified into one of 6 levels of hydrological unit code (HUC). HUCs are useful in providing more detailed information about a localized drainage area and also maintain context of its function within the whole river basin system.

Watersheds are further described with Strahler's stream classification system. Strahler's stream order measures the relative size of streams within a watershed. The smallest tributaries are referred to as first-order streams. As multiple streams meet, their order increases at each additional confluence (See Figure 1). First through third-order streams are referred to as headwater streams. The largest river in Kentucky is the Ohio River, a ninth-order waterway. The largest river in the world is the Amazon River, a twelfth-order waterway.

**Figure 1.**
Strahler's Stream Order: Classification system describing position within the drainage network.



Individual stream lengths are further described in three categories:

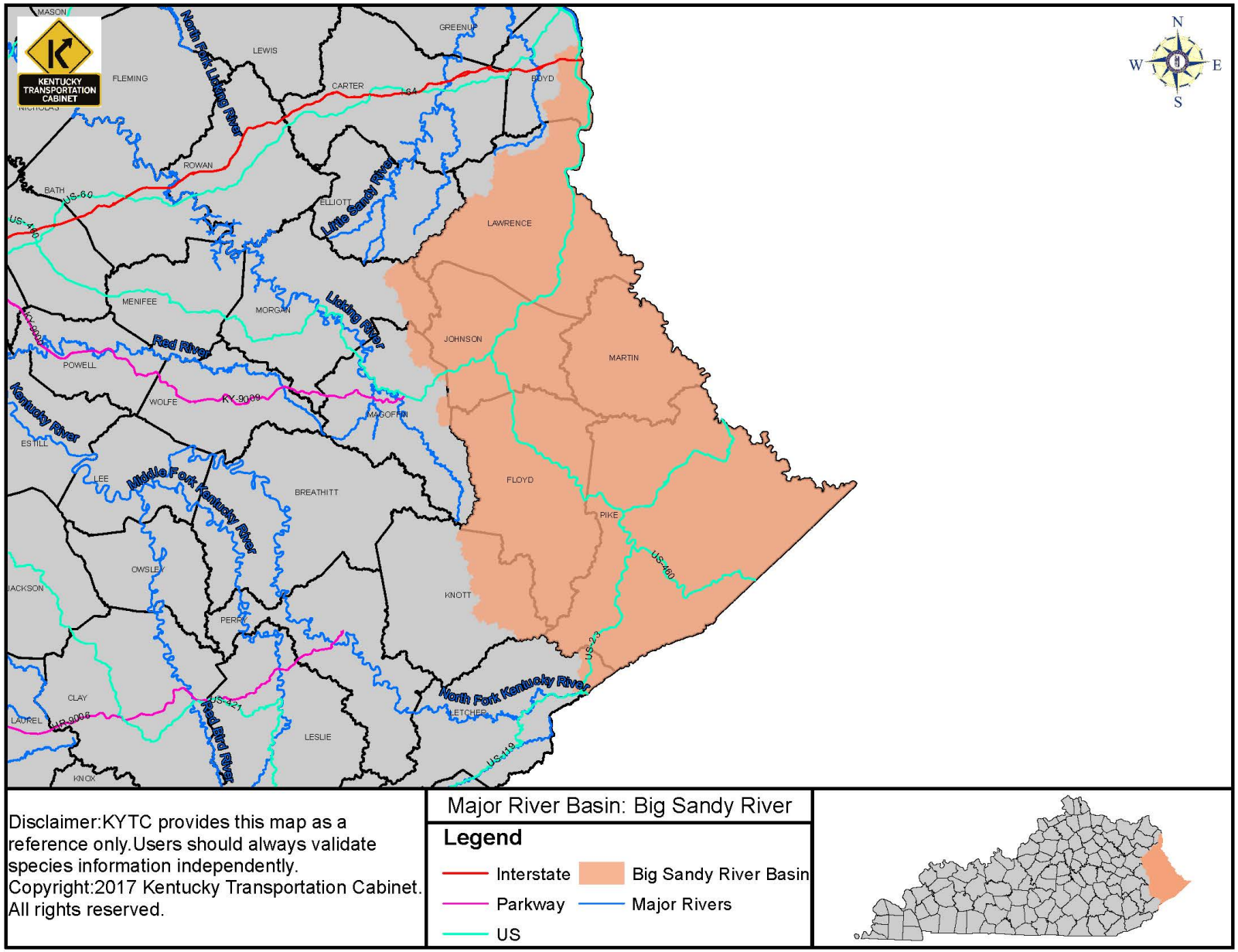
1. *Ephemeral* - Small, temporary streams which occur only during heavy rainstorm. Stream channels are often undefined or heavily lined with grass/vegetation.
2. *Intermittent* - Flow occurs only part of the year from springs or rain event runoff. Can still support aquatic life in dry times with a series of disconnected pools.
3. *Perennial* - Flow occurs year–round and has a defined channel.

First-order streams may be either ephemeral, intermittent, or perennial dependent on its relation to groundwater connection.

Due to the dependence on waterbody connectivity for fish travel from one area to another, Kentucky's watersheds provide unique and isolated habitats for many native and rare fish species. The variety and isolated nature of Kentucky's many watersheds is why this state provides some of the greatest fish diversity in North America.

In regards to the protection of endangered species, fish are confined mostly to perennial and some intermittent rivers and streams within a specific river basin. Habitat potential for endangered species is better defined by watershed than by county, since multiple watersheds can occur within a single county. Occasionally fishes can be transferred outside of their basin by human activities such as an accidental bait bucket release.

The following maps depict the locations of the 13 river basins of Kentucky.


KENTUCKY TRANSPORTATION CABINET
N
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MASON
FLEMING
LEWIS
GREENUP
CARTER
I-64
BOYD
North Fork Licking River
ROWAN
BATH
US-60
US-460
ELLIOTT
Little Sandy River
LAWRENCE
MENIFEE
MORGAN
Licking River
JOHNSON
MARTIN
Red River
POWELL
WOLFE
KY-9009
MAGOFFIN
Kentucky River
ESTILL
LEE
Middle Fork Kentucky River
BREATHITT
FLOYD
PIKE
OWSLEY
JACKSON
KNOTT
PERRY
US-23
US-460
North Fork Kentucky River
CLAY
LAUREL
KY-9006
US-421
Red Bird River
LESLIE
LETCHER
US-119
KNOX
Disclaimer:KYTC provides this map as a reference only.Users should always validate species information independently.
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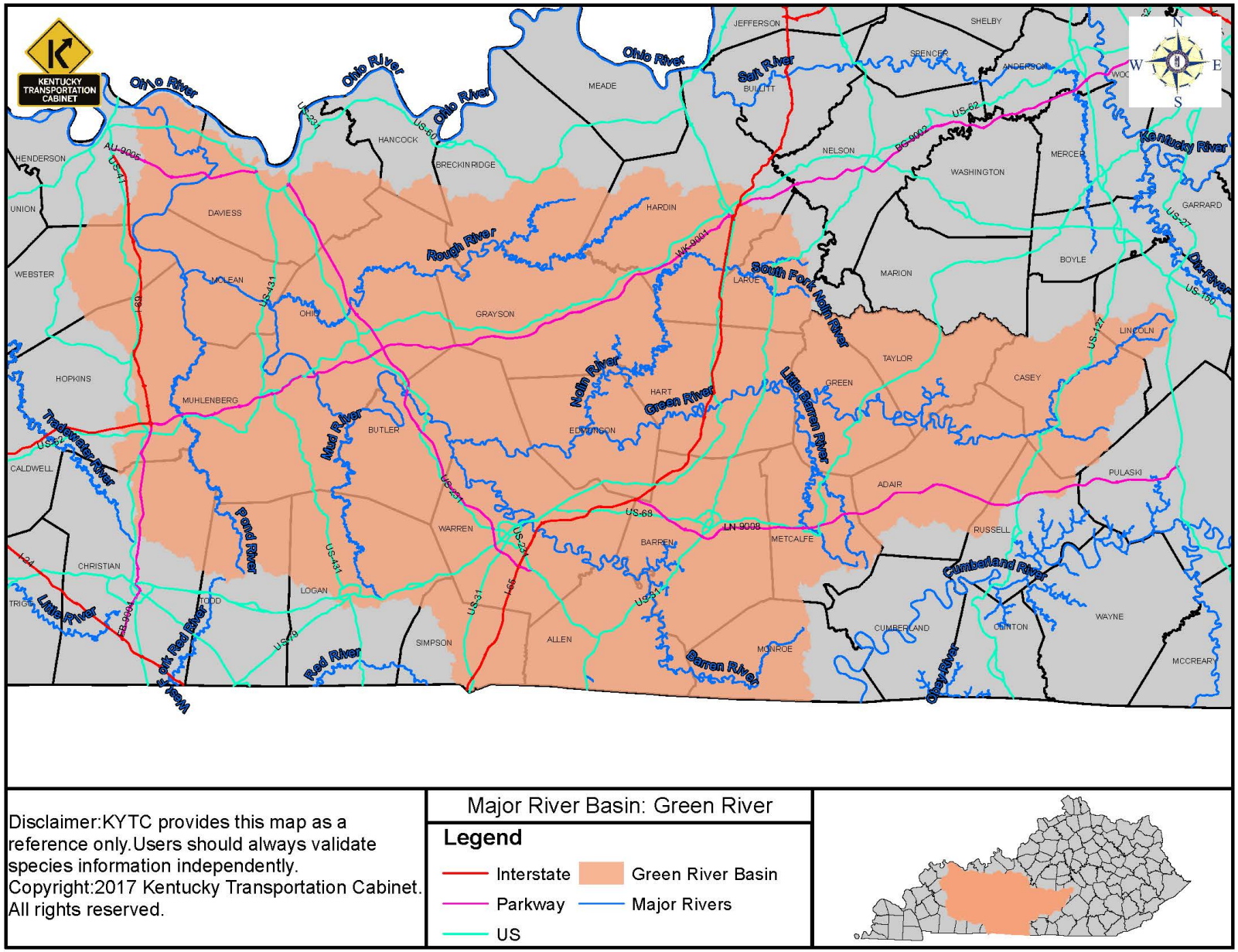
Major River Basin: Big Sandy River
Legend
Interstate
Parkway
US
Big Sandy River Basin
Major Rivers

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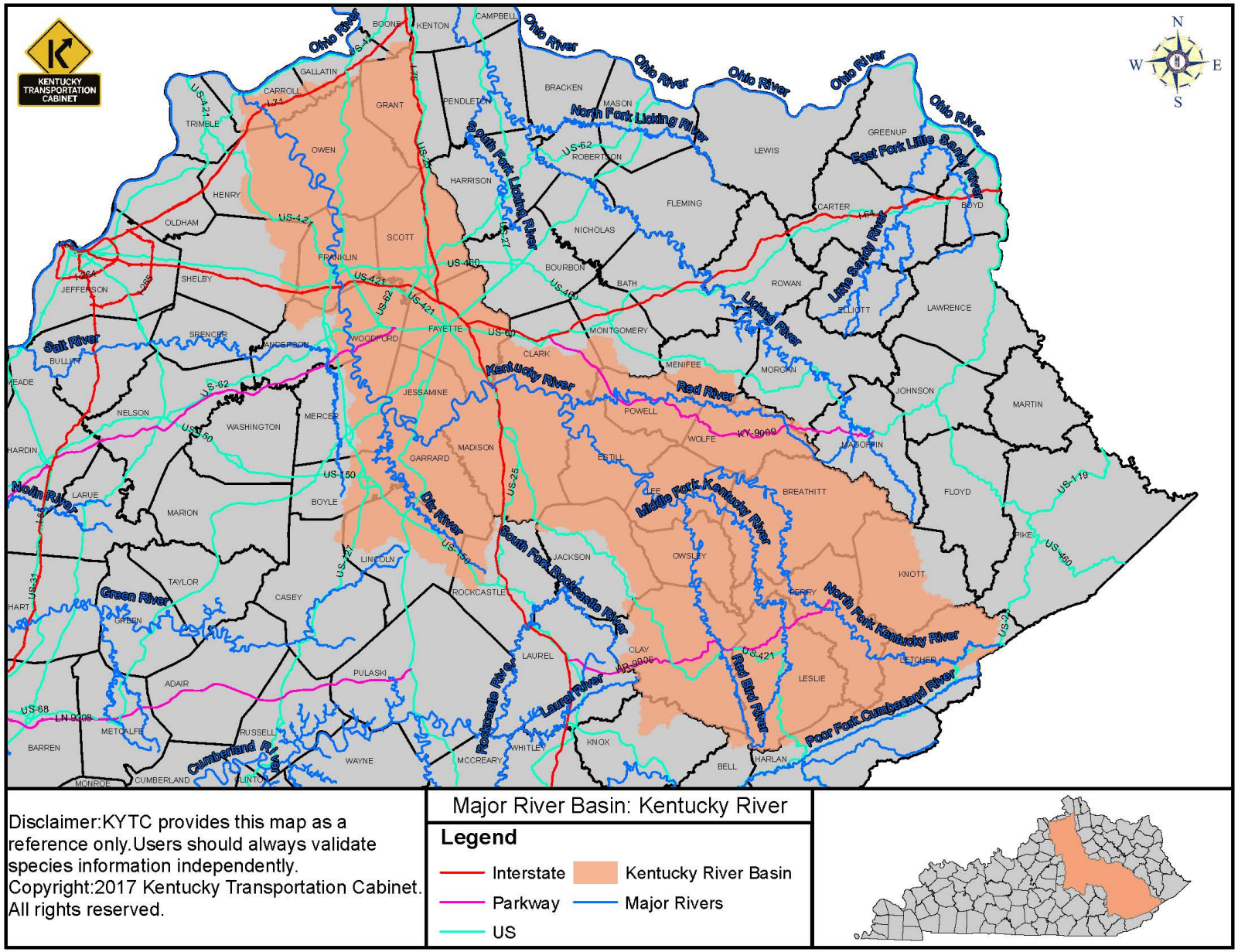
Major River Basin: Green River

**Legend**

- Interstate
- Parkway
- US
- Green River Basin
- Major Rivers


KENTUCKY TRANSPORTATION CABINET
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Ohio River
North Fork Licking River
South Fork Licking River
East Fork Little Sandy River
Little Sandy River
Licking River
Kentucky River
Red River
Salt River
Dix River
Middle Fork Kentucky River
South Fork Rockcastle River
Rockcastle River
Laurel River
Red Bird River
North Fork Kentucky River
Poor Fork Cumberland River
Cumberland River
Green River
Nolin River
BOONE
KENTON
CAMPBELL
GALLATIN
CARROLL
GRANT
PENDLETON
BRACKEN
MASON
ROBERTSON
LEWIS
GREENUP
BOYD
CARTER
TRIMBLE
OWEN
HARRISON
FLEMING
HENRY
OLDHAM
SCOTT
NICHOLAS
BOURBON
BATH
ROWAN
ELLIOTT
LAWRENCE
FRANKLIN
SHELBY
JEFFERSON
FAYETTE
WOODFORD
CLARK
MONTGOMERY
MENIFEE
MORGAN
JOHNSON
MARTIN
SPENCER
ANDERSON
BULLITT
MEADE
JESSAMINE
POWELL
WOLFE
MAGOFFIN
NELSON
WASHINGTON
MERCER
MADISON
GARRARD
ESTILL
BREATHITT
FLOYD
HARDIN
LARUE
MARION
BOYLE
LEE
PIKE
TAYLOR
CASEY
LINCOLN
JACKSON
OWSLEY
KNOTT
ROCKCASTLE
PERRY
HART
GREEN
CLAY
LAUREL
LETCHER
ADAIR
PULASKI
LESLIE
BARREN
METCALFE
RUSSELL
WAYNE
KNOX
WHITLEY
MCCREARY
BELL
HARLAN
MONROE
CUMBERLAND
CLINTON
US-421
US-62
US-60
US-150
US-25
US-27
US-68
US-31
US-119
US-460
KY-9009
KY-9006
LN-9008
I-71
I-64
I-265
I-75
I-24
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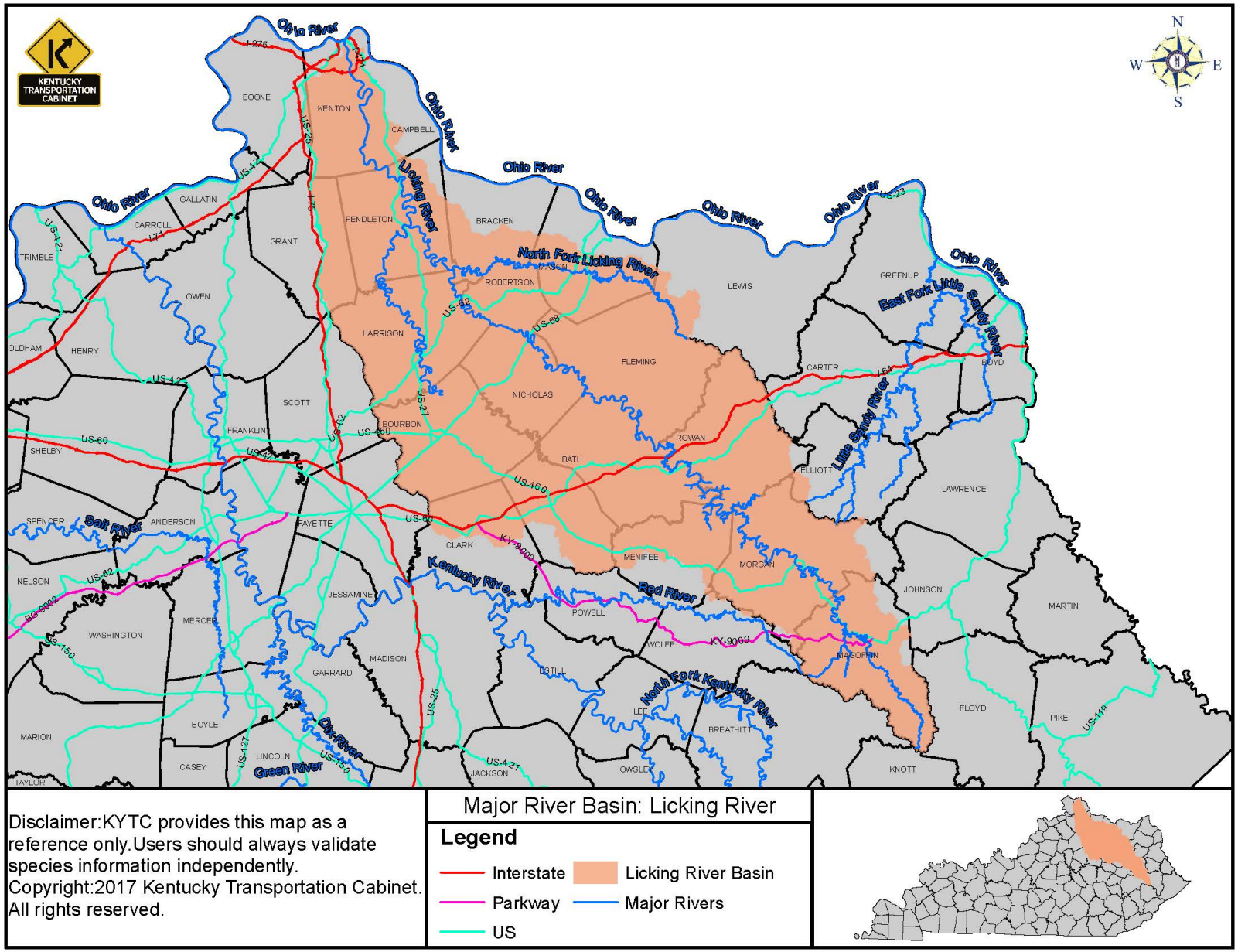
Major River Basin: Kentucky River
Legend
Interstate
Parkway
US
Kentucky River Basin
Major Rivers

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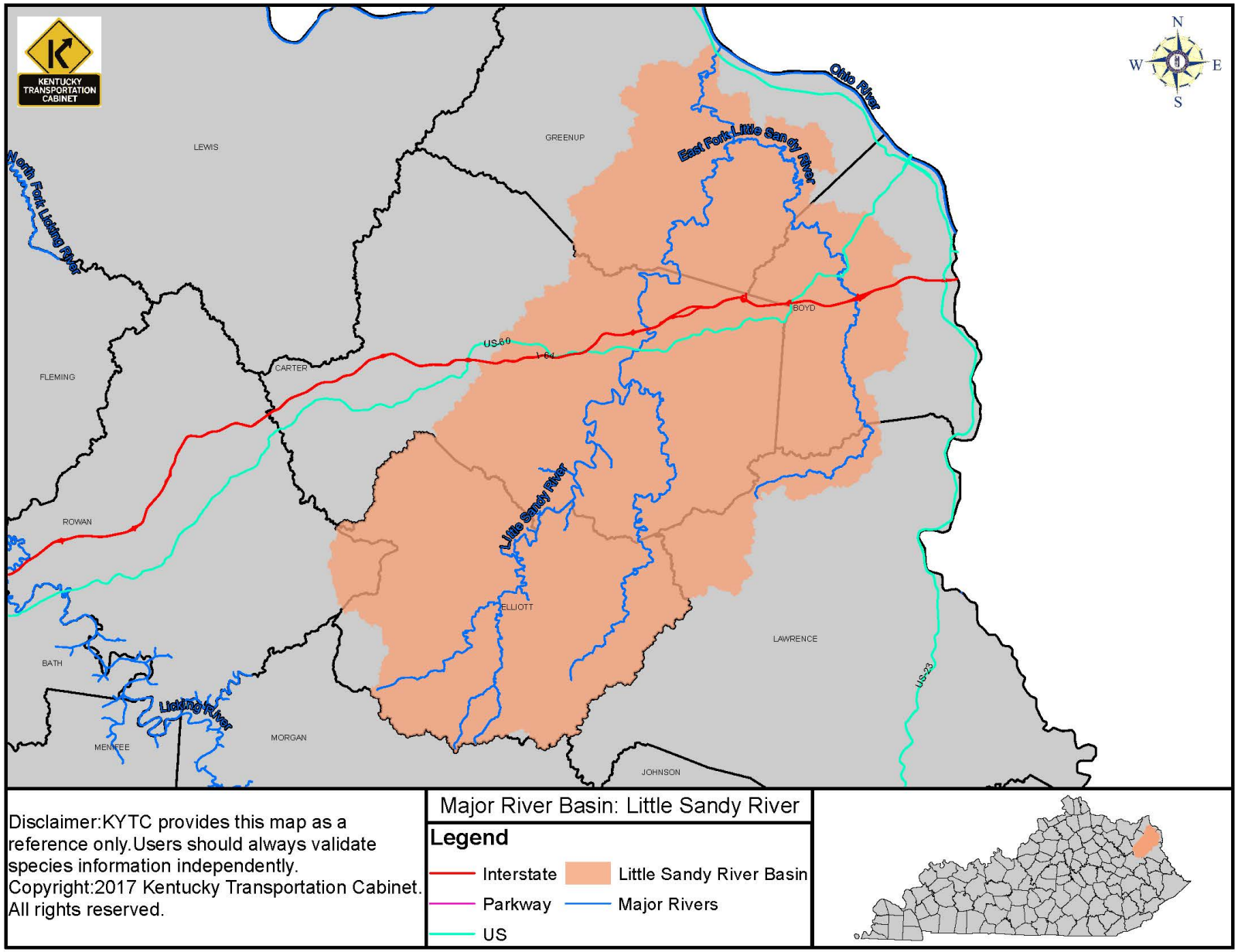
KENTUCKY TRANSPORTATION CABINET
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East Fork Little Sandy River
North Fork Licking River
Little Sandy River
Licking River
LEWIS
GREENUP
BOYD
CARTER
FLEMING
ROWAN
ELLIOTT
LAWRENCE
BATH
MENIFEE
MORGAN
JOHNSON
US 60
I 64
US-23
Disclaimer:KYTC provides this map as a reference only.Users should always validate species information independently.
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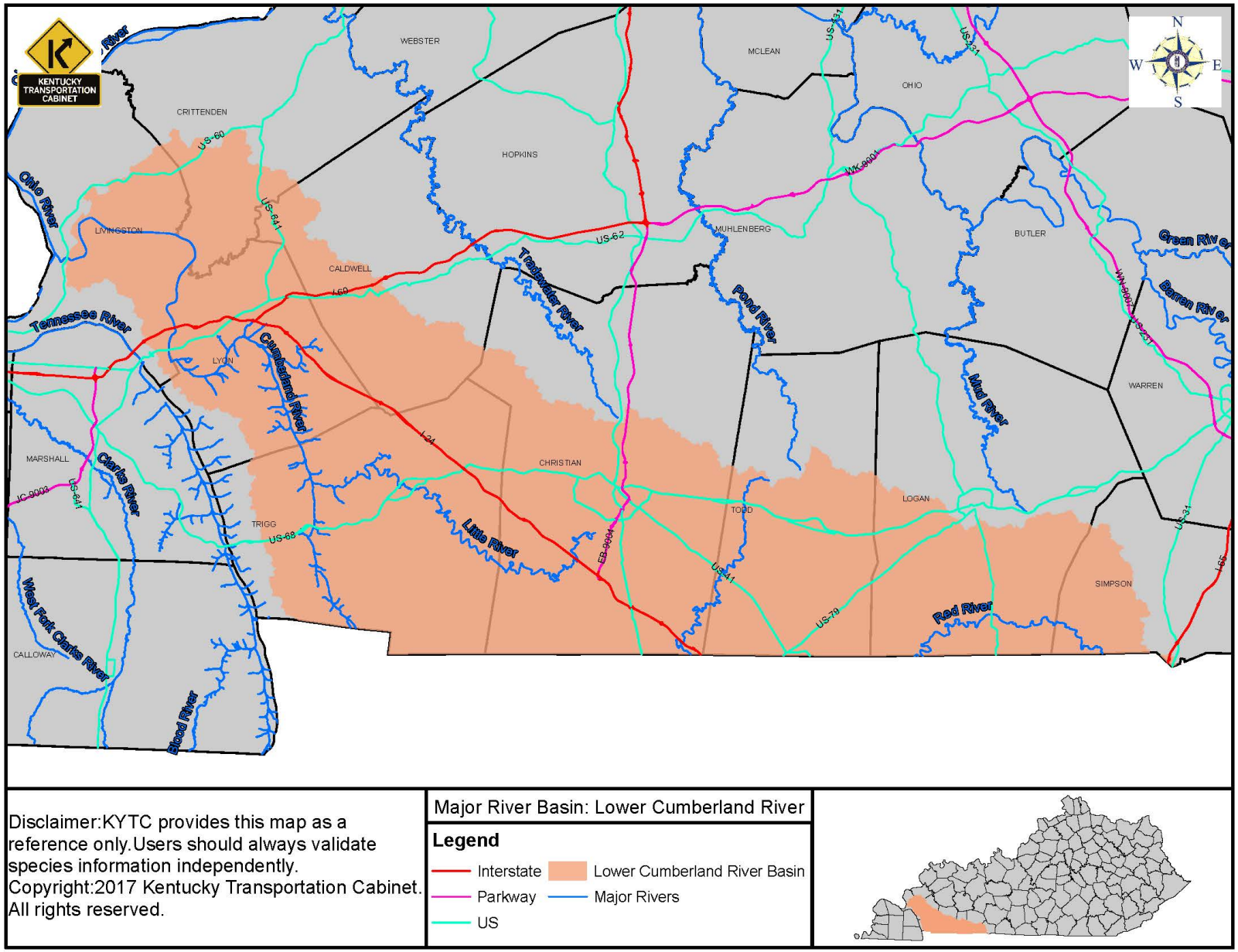
Major River Basin: Little Sandy River
Legend
Interstate
Parkway
US
Little Sandy River Basin
Major Rivers

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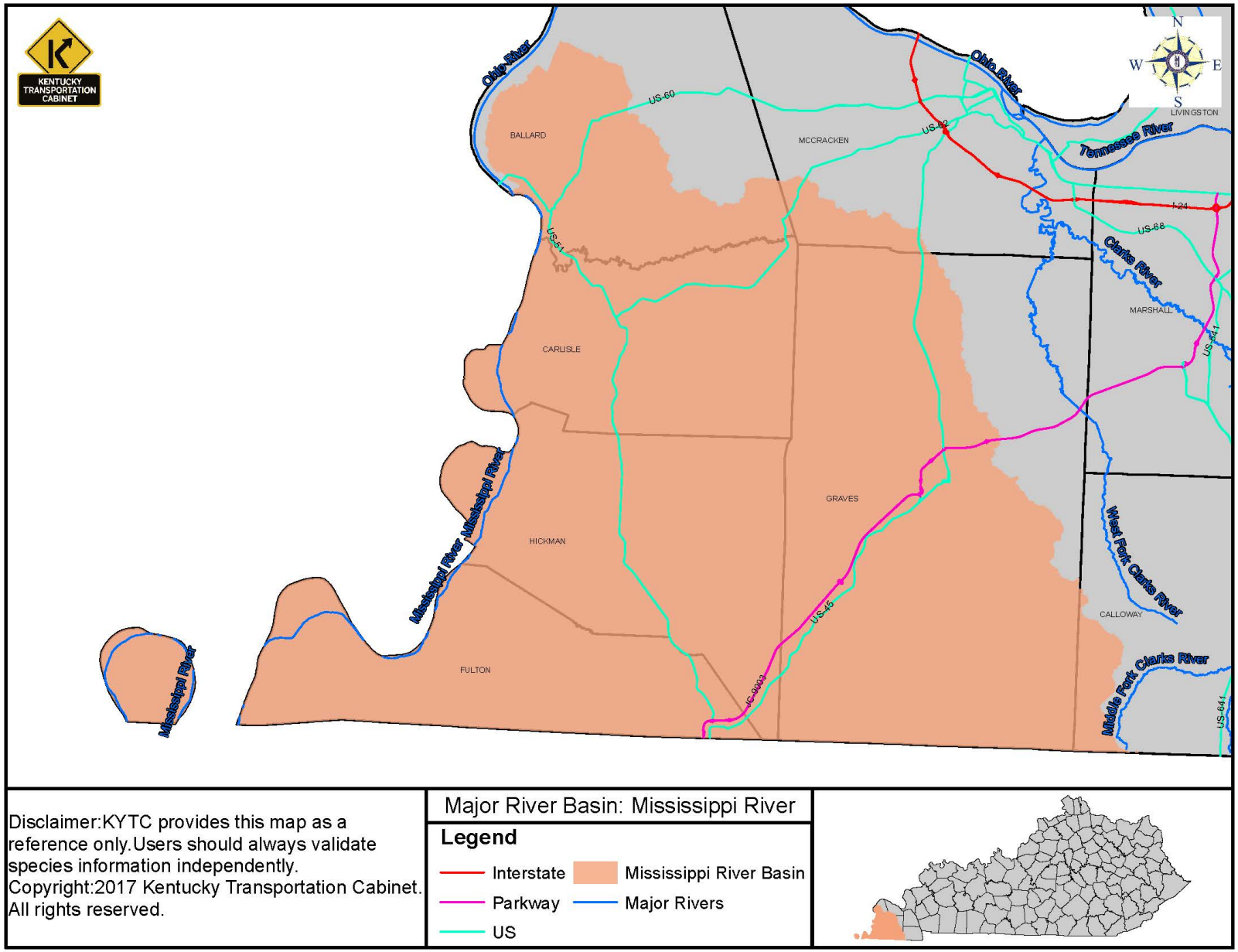
Major River Basin: Lower Cumberland River

**Legend**

- Interstate
- Parkway
- US
- Lower Cumberland River Basin
- Major Rivers

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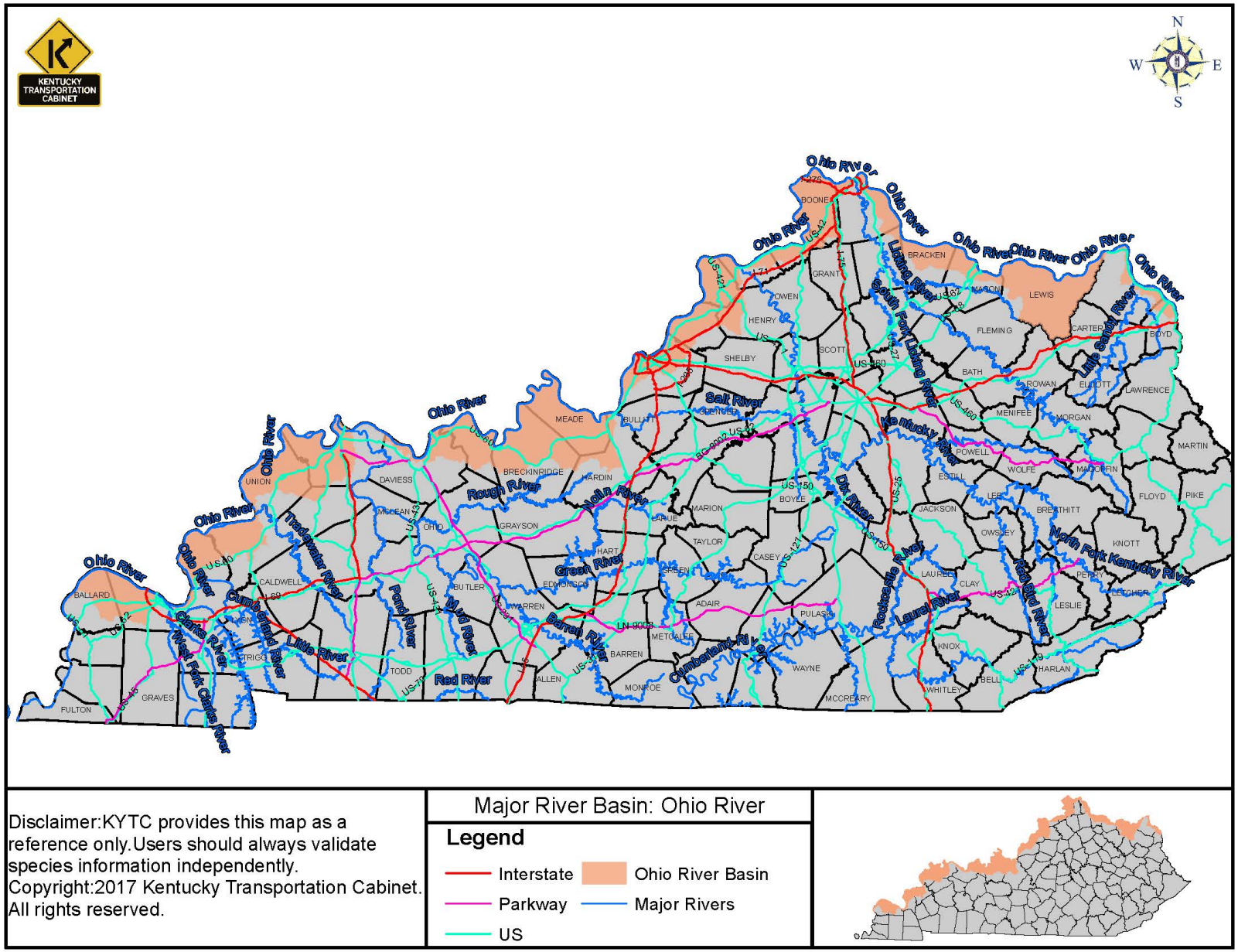
Major River Basin: Mississippi River

**Legend**

- Interstate
- Parkway
- US
- Mississippi River Basin
- Major Rivers


KENTUCKY TRANSPORTATION CABINET
N
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Ohio River
Licking River
South Fork Licking River
Little Sandy River
Salt River
Kentucky River
Dix River
Rough River
Nolin River
Green River
Barren River
Tradewater River
Pond River
Muddy River
Red River
Little River
Cumberland River
Rockcastle River
Laurel River
Big Sandy River
North Fork Kentucky River
Clarks River
West Fork Clarks River
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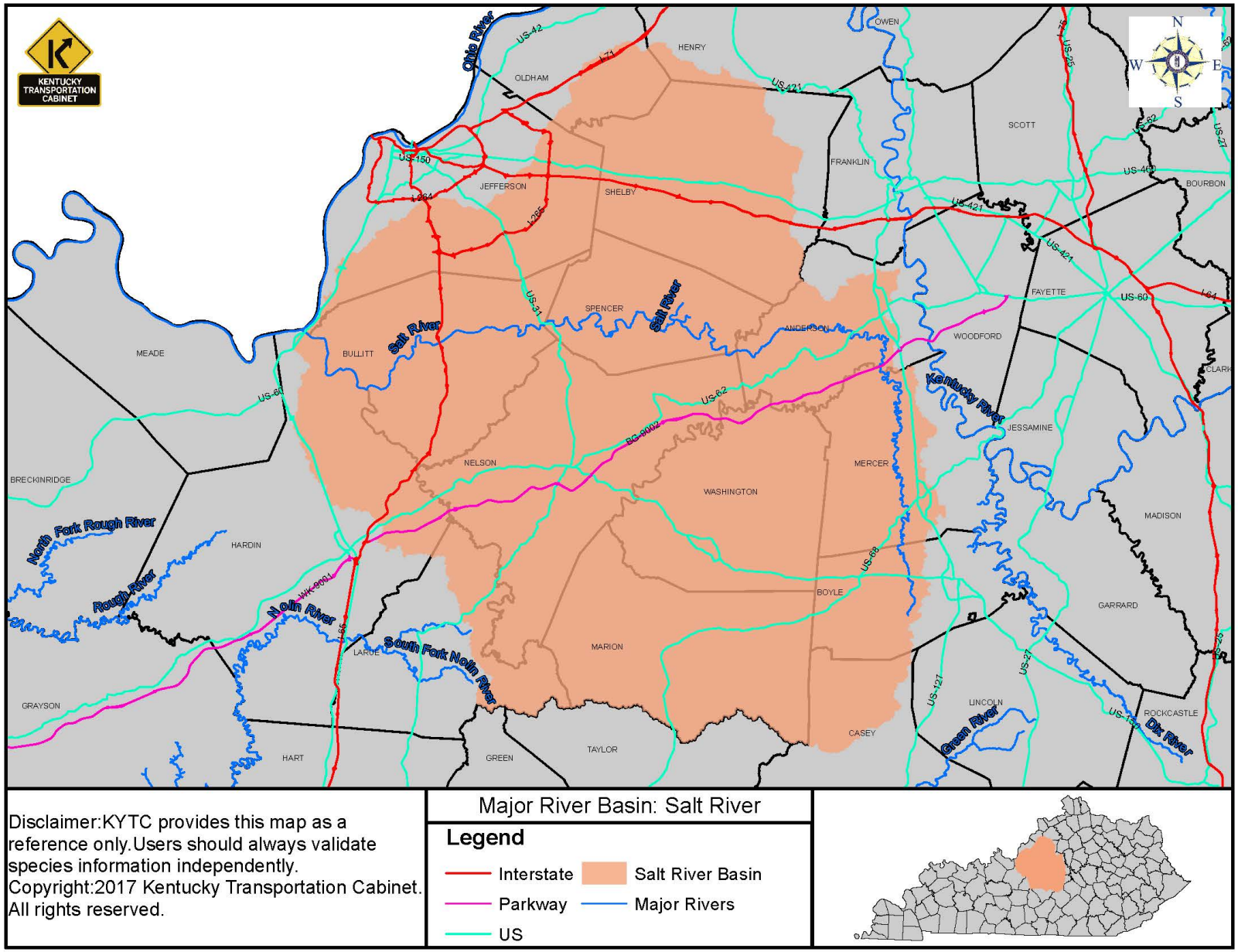
Major River Basin: Ohio River
Legend
Interstate
Parkway
US
Ohio River Basin
Major Rivers

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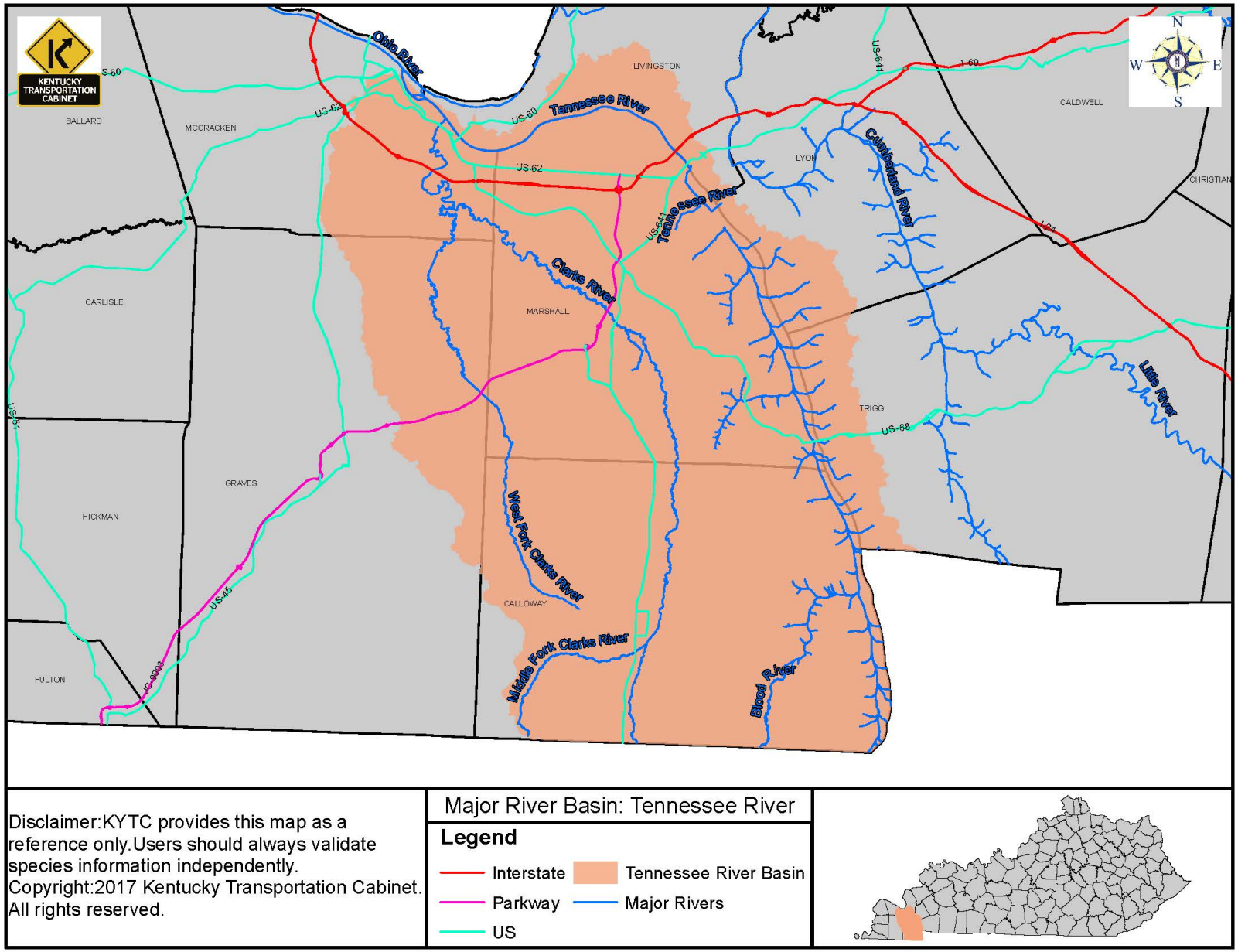
KENTUCKY TRANSPORTATION CABINET
Ohio River
Tennessee River
Tennessee River
Cumberland River
Clarks River
West Fork Clarks River
Middle Fork Clarks River
Blood River
Little River
BALLARD
MCCRACKEN
LIVINGSTON
CALDWELL
LYON
CHRISTIAN
CARLISLE
MARSHALL
TRIGG
GRAVES
HICKMAN
CALLOWAY
FULTON
US-60
US-62
US-641
I-69
I-24
US-68
US-45
US-51
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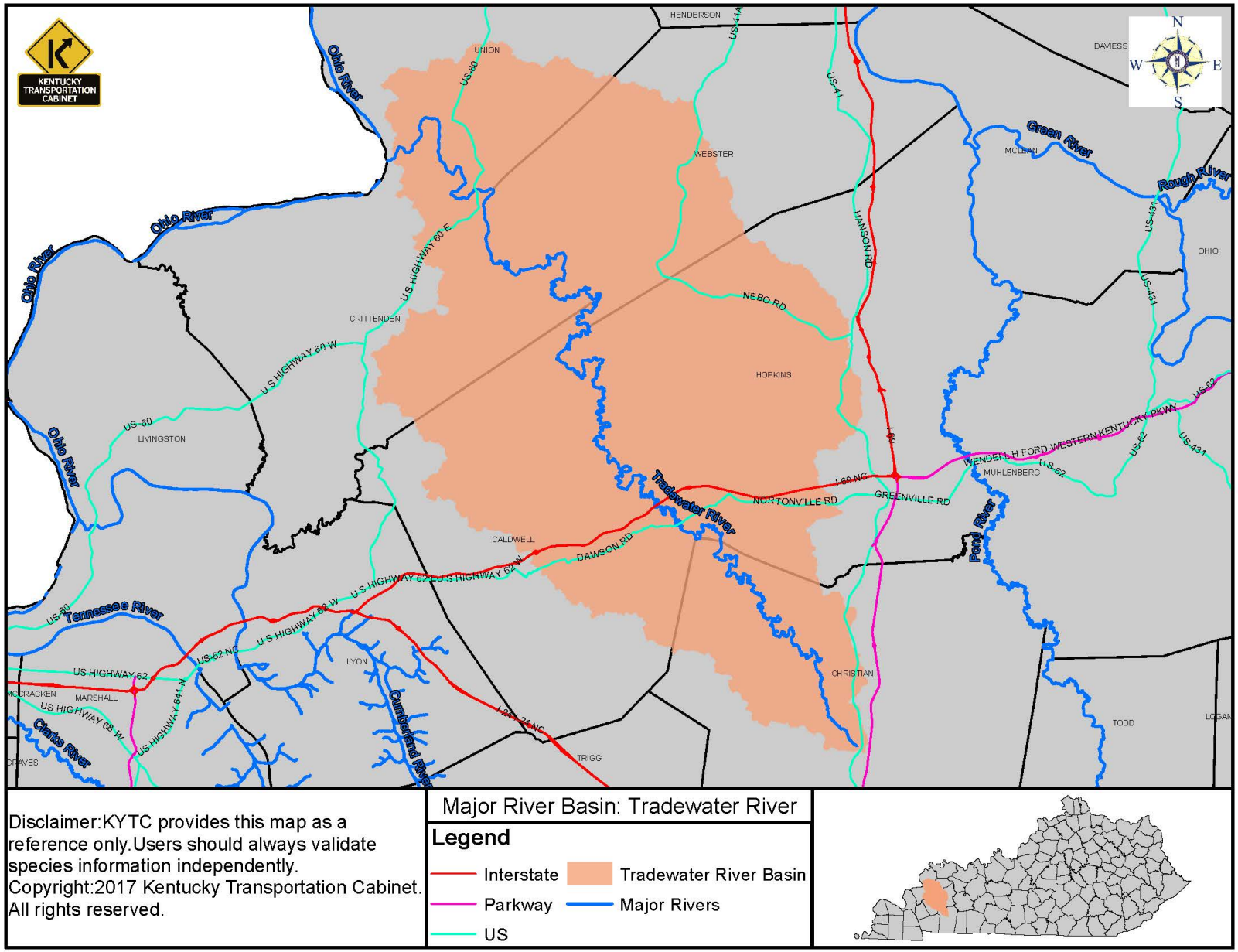
Major River Basin: Tennessee River
Legend
Interstate
Parkway
US
Tennessee River Basin
Major Rivers

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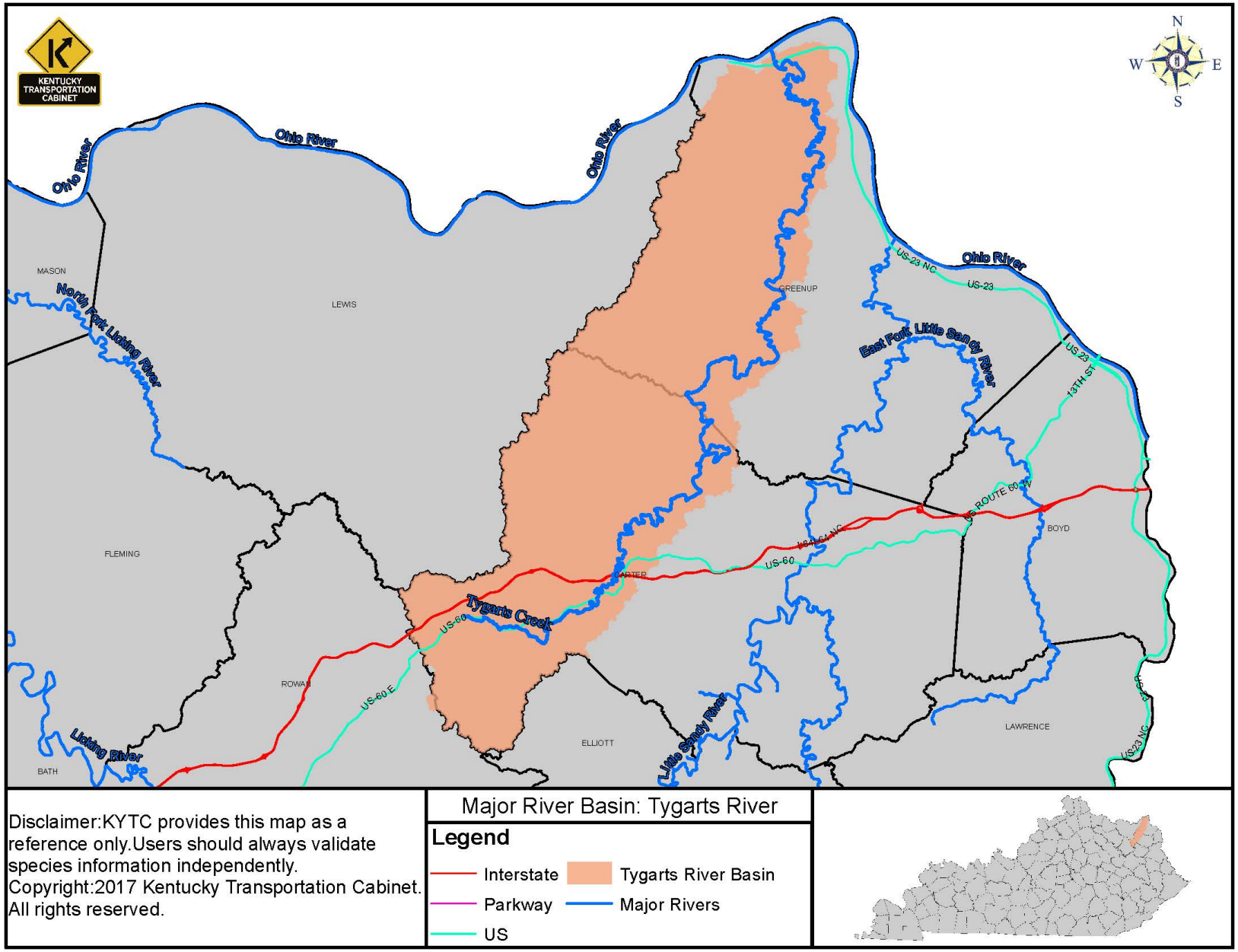
Major River Basin: Tradewater River

**Legend**

- Interstate
- Parkway
- US
- Tradewater River Basin
- Major Rivers


KENTUCKY TRANSPORTATION CABINET
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Ohio River
Ohio River
MASON
LEWIS
GREENUP
North Fork Licking River
East Fork Little Sandy River
US-23 NC
US-23
US 23
13TH ST
US ROUTE 60 W
BOYD
FLEMING
CARTER
US-60
US-60
Tygarts Creek
ROWAN
US-60 E
Licking River
BATH
ELLIOTT
Little Sandy River
LAWRENCE
US23 NC
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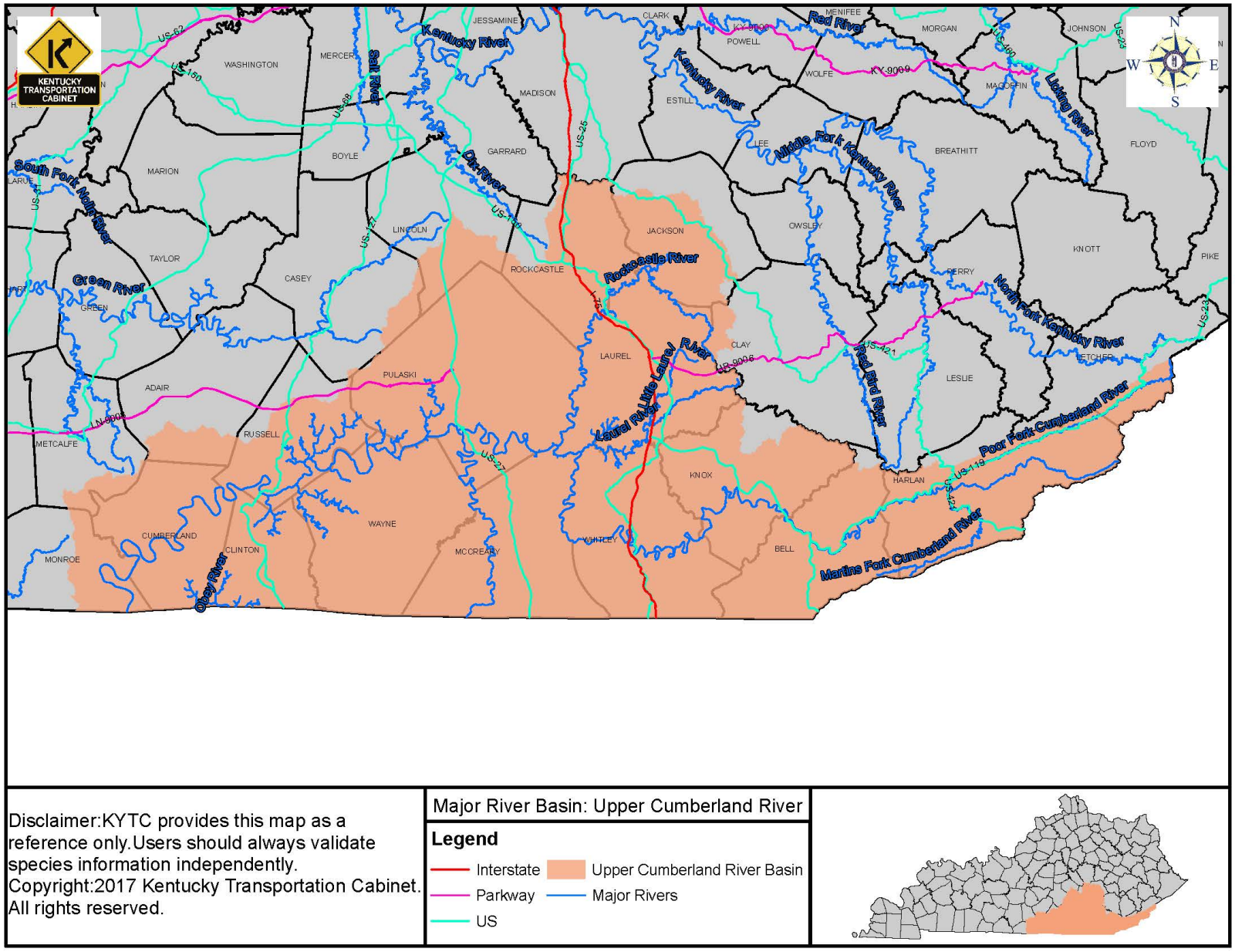
Major River Basin: Tygarts River
Legend
Interstate
Parkway
US
Tygarts River Basin
Major Rivers


KENTUCKY TRANSPORTATION CABINET
Kentucky River
Red River
Salt River
Dix River
South Fork Nolin River
Green River
Rockcastle River
Laurel River
Little Laurel River
Red Bird River
North Fork Kentucky River
Middle Fork Kentucky River
Poor Fork Cumberland River
Martins Fork Cumberland River
Obey River
Licking River
JESSAMINE
CLARK
MENIFEE
MORGAN
JOHNSON
WASHINGTON
MERCER
BOYLE
MADISON
GARRARD
POWELL
WOLFE
ESTILL
MAGOFFIN
FLOYD
LEE
BREATHITT
MARION
LINCOLN
JACKSON
OWSLEY
KNOTT
PIKE
PERRY
TAYLOR
CASEY
ROCKCASTLE
CLAY
LESLIE
LETCHER
GREEN
ADAIR
PULASKI
LAUREL
RUSSELL
METCALFE
KNOX
HARLAN
BELL
WHITLEY
WAYNE
MCCREARY
CUMBERLAND
CLINTON
MONROE
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Major River Basin: Upper Cumberland River
Legend
Interstate
Parkway
US
Upper Cumberland River Basin
Major Rivers

# Blackside Dace (*Chrosomus cumberlandensis*)

Formerly known as: *Phoxinus cumberlandensis*

## Species Description

Blackside dace was listed as **threatened** in 1987.

Photo Credit: Bert Remley, Third Rock Consultants, Inc.

Distinguishing characteristics for this species are its single black lateral stripe, green/gold back with black specks, with a scarlet belly (varies from pale to brilliant). Fins are bright yellow with metallic silver surrounding the base of the pelvic and pectoral fins.

## Habitat Description

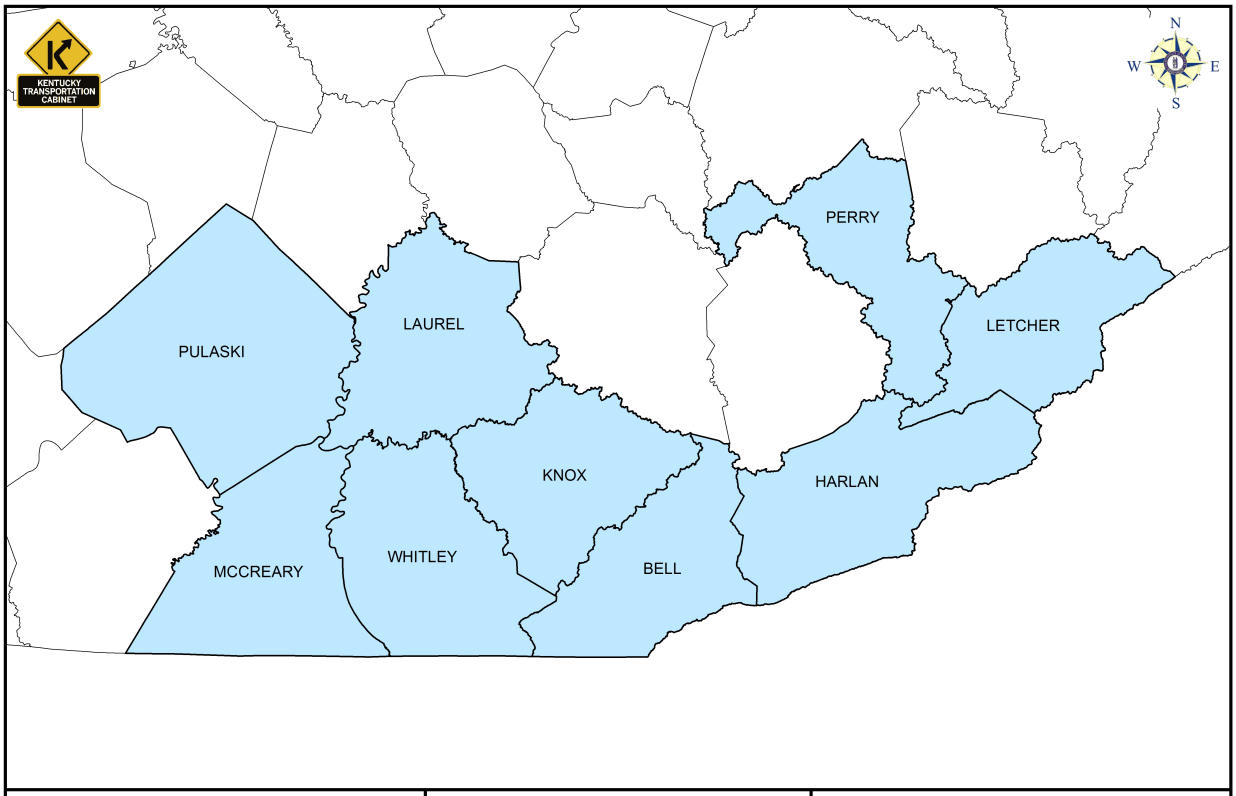
Blackside dace (BSD) inhabit perennial headwater (1st -3rd order) streams that have a wetted width of 6–17 feet and relatively high riffle-pool ratios (35-50 % riffles). BSD streams have a moderate current velocity because of an ideal gradient ranging from 1–6 %. They are not found in steeper, high gradient (>6%) upper headwater reaches, or in low gradient (<1%) downstream reaches with a much higher proportion of deeper pools that contain large predators. Other habitat factors that correlate well with the presence of BSD are low turbidity and low silt loads, conductivity below 450µS/cm, and relatively cool summer water temperatures (i.e., good riparian cover and shading). Adult BSD are found in pools with undercut banks, root wads, or over-hanging vegetation. Pool depth can vary from less than a foot to more than three feet. Fry and small juveniles inhabit the shallow edges of pools, or more commonly, very shallow runs, Spawning areas are generally located in pools just above or just below the riffles where the current is sufficient to keep the gravel swept free of silt.

## Critical Habitat

None

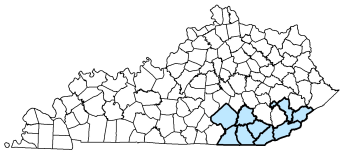
## Range

Historically, BSD were limited to the Upper Cumberland River System in southeastern Kentucky northeastern Tennessee. However, in 2013 BSD were found in the Big South Fork of the Cumberland River Drainage, and also in the Powell River and Clinch River in Virginia. In addition, a 2013 KYTC fish survey found BSD in the Kentucky River drainage within the Right Fork Maces Creek in Perry County, KY. Although all federally endangered and threatened species are protected 'wherever found', this R. Fork Maces Creek location is considered to be an isolated occurrence so BSD populations elsewhere in Perry County are considered unlikely.




Disclaimer:KYTC provides this map as a reference only.Users should always validate species information independently.


Species Range Map: Blackside Dace



## Decision Key

1) Does the project include any direct or indirect effects on perennial (1st – 3rd order) streams or nearby tributaries in the Upper Cumberland or Big South Fork of the Cumberland River Drainage or within the Right Fork Maces Creek in Perry County? (e.g. remove riparian vegetation, alter stream banks, change water levels/flow, dredge, construct/remove bridge piers)

    a. Yes: Contact SME
    b. No: Prepare NE finding

## Literature Cited

U.S. Fish and Wildlife Service. Determination of Threatened Species Status for Blackside Dace, Final Rule. *Federal Register* 52: 22580 – 22585.

Bivens, R.D., B.D. Carter, C.E. Williams, E.M. Scott Jr., D.E. Stephens, V.R. Bishop, and H.T.

Mattingly. 2013. New Occurrence Records of Blackside Dace, *Chrosomus cumberlandensis*, in the Big South Fork Cumberland River Drainage. Southeastern Naturalist, 12: 171-175.

# Cumberland Darter (*Etheostoma susanae*)

## Species Description

The Cumberland darter was listed as **endangered** in September 2011.

This rare fish may reach lengths up to 2.5 inches. It is pale yellow in color with six brown saddle-like markings on the sides. During the breeding season, theses markings on males fade and the fish become darker.

Photo Credit: http://conservationfisheries.org

## Habitat Description

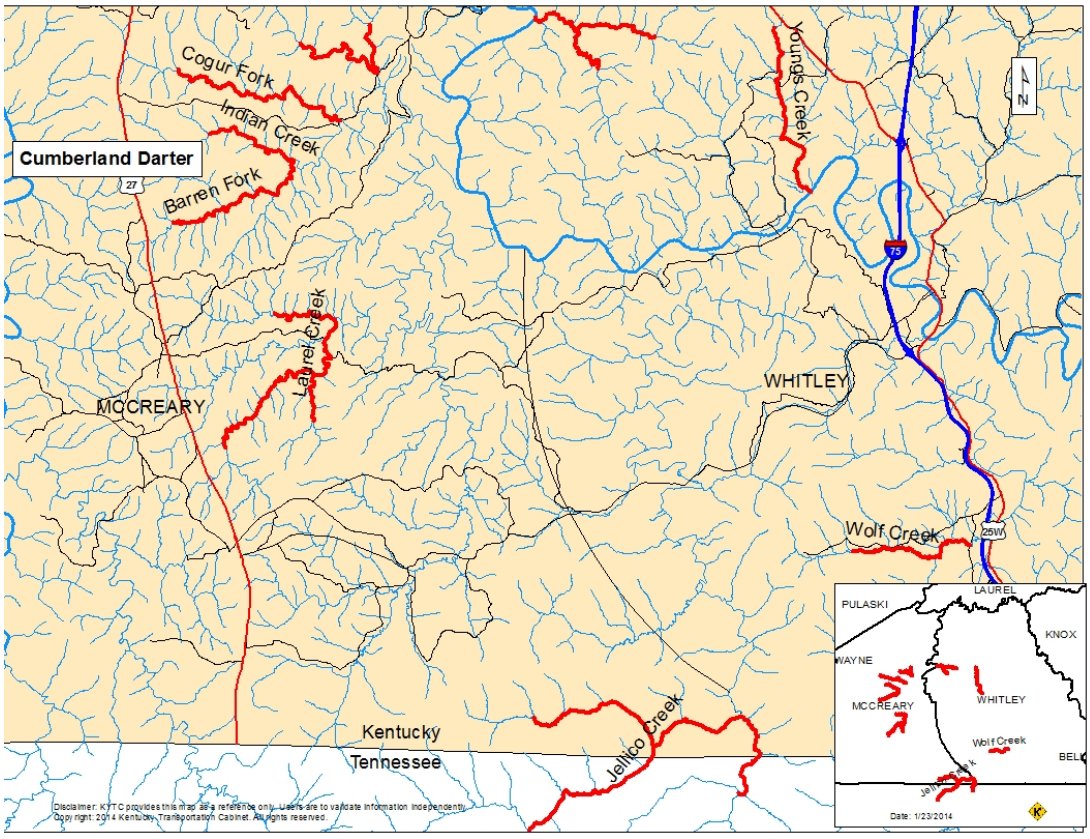
The Cumberland darter inhabits pools or shallow runs of low–moderate gradient sections of streams with stable sand, silt, or sand-covered bedrock. Stream size ranges from 2$^{nd}$–4$^{th}$ order streams, 11-30 feet wide and 8–30 inches deep.

## Critical Habitat

Yes

TABLE 1—OCCUPANCY AND OWNERSHIP OF THE DESIGNATED CRITICAL HABITAT UNITS FOR THE CUMBERLAND DARTER

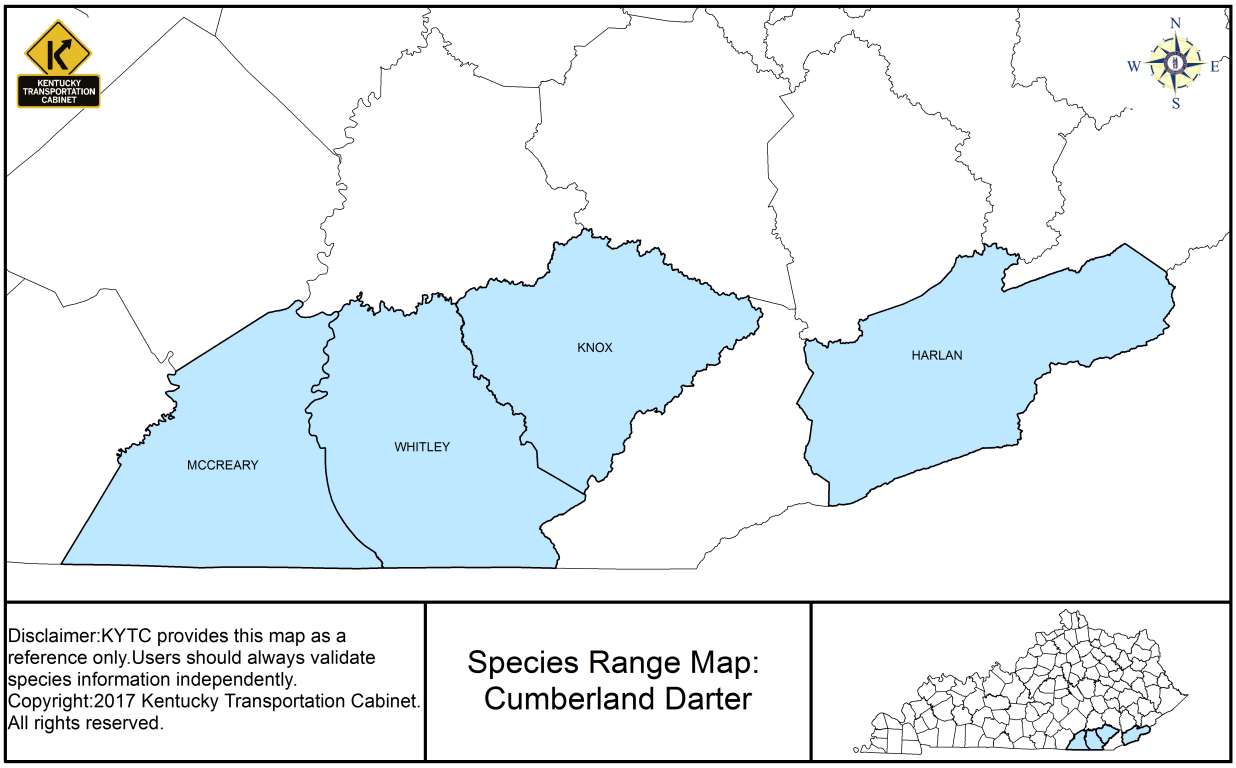
| Unit | Location | Occupied | Private ownership rkm (rmi) | Federal, state, county, city ownership rkm (rmi) | Total length rkm (rmi) |
|---|---|---|---|---|---|
| 1 | Bunches Creek | Yes | 0 | 5.8 (3.6) | 5.8 (3.6) |
| 2 | Calf Pen Fork | Yes | 0 | 2.9 (1.8) | 2.9 (1.8) |
| 3 | Youngs Creek | Yes | 7.4 (4.6) | 0 | 7.4 (4.6) |
| 4 | Barren Fork | Yes | 0 | 6.3 (3.9) | 6.3 (3.9) |
| 5 | Indian Creek | No | 0 | 4.0 (2.5) | 4.0 (2.5) |
| 6 | Cogur Fork | Yes | 2.7 (1.7) | 5.9 (3.7) | 8.6 (5.4) |
| 7 | Kilburn Fork | No | 0.9 (0.6) | 3.7 (2.3) | 4.6 (2.9) |
| 8 | Laurel Fork | Yes | 1.3 (0.8) | 2.2 (1.4) | 3.5 (2.2) |
| 9 | Laurel Creek | Yes | 0.6 (0.4) | 8.8 (5.5) | 9.4 (5.9) |
| 10 | Elisha Branch | Yes | 0 | 2.1 (1.3) | 2.1 (1.3) |
| 11 | Jenneys Branch | Yes | 0 | 3.1 (1.9) | 3.1 (1.9) |
| 12 | Wolf Creek | Yes | 6.3 (3.9) | 0 | 6.3 (3.9) |
| 13 | Jellico Creek | Yes | 8.2 (5.1) | 3.3 (2.1) | 11.5 (7.2) |
| 14 | Rock Creek | Yes | 3.9 (2.4) | 2.2 (1.4) | 6.1 (3.8) |
| 15 | Capuchin Creek | Yes | 3.4 (2.1) | 0.8 (0.5) | 4.2 (2.6) |
| Total | | | | | 85.8 (53.5) |




Above is a map of the critical habitat for Cumberland darter in McCreary and Whitley Counties.

## Range

The Federal Register states that the Cumberland darter is known from 15 occurrences in 13 streams in McCreary and Whitley Counties. Its potential habitat is small streams in the upper Cumberland drainage **above** the Falls (of the Cumberland). Refer to critical habitat for stream locations.




## Decision Key

1) Does the project include any direct or indirect effects to perennial (2nd–4th order) streams in the Cumberland River drainage above the Falls (e.g. remove riparian vegetation, alter stream banks, change water levels/flow, dredge, construct/remove bridge piers)?

    a. Yes: Contact SME
    b. No: Prepare NE finding

## Literature Cited

U.S Fish and Wildlife Service. 2011. Endangered Status for the Cumberland Darter, Rush Darter, Yellowcheek Darter, Chuck Madtom, and Laurel Dace: Final Rule. *Federal Register* 75: 48722–48741.

U.S Fish and Wildlife Service. 2011. Designation of Critical Habitat for the Cumberland Darter, Rush Darter, Yellowcheek Darter, Chucky Madtom, and Laurel Dace: Final Rule. *Federal Register* 77: 63603–63668.

# Diamond Darter (*Crystallaria cincotta*)

## Species Description

The diamond darter was listed as **endangered** in August 2013.


The diamond darter is considered one of the "Desperate Dozen", the 12 species most likely to become extinct which conservation efforts are focused on.

This small member of the perch family is translucent with silvery sides and a white underbelly. The body and head is yellow-tan with four wide, olive-brown saddles on the body. There is also a dark both on the snout below the eyes. Adults can reach 3 to 5 inches in size.

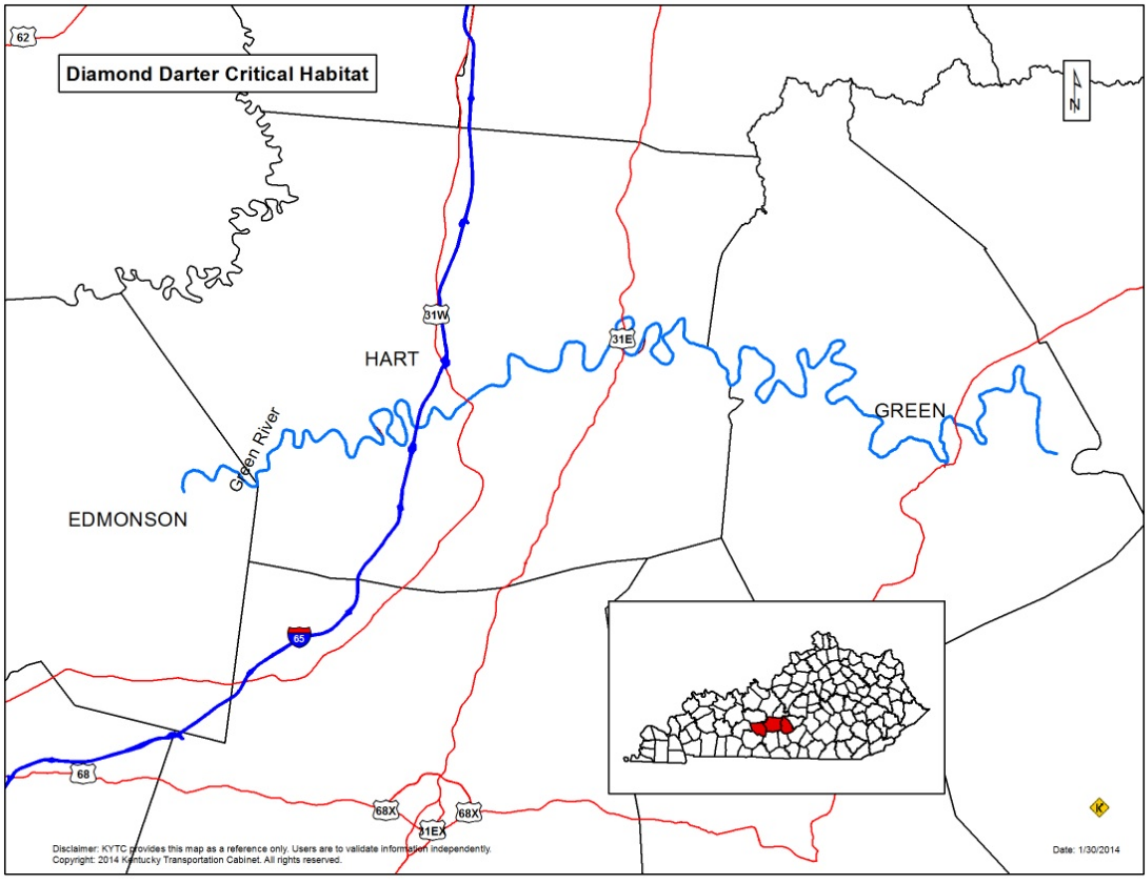
## Habitat Description

The diamond darter inhabits medium to large (e.g. Ohio, Cumberland, and Green River), warm water streams with moderate current and clean sand and gravel bars. It has been collected in riffles and pools, and is known to be nocturnal, burrowing into the substrate during daylight.

The widespread loss of the diamond darter has been related to effects from impoundment of rivers from dams, siltation of the river bottom habitat, and poor water quality.

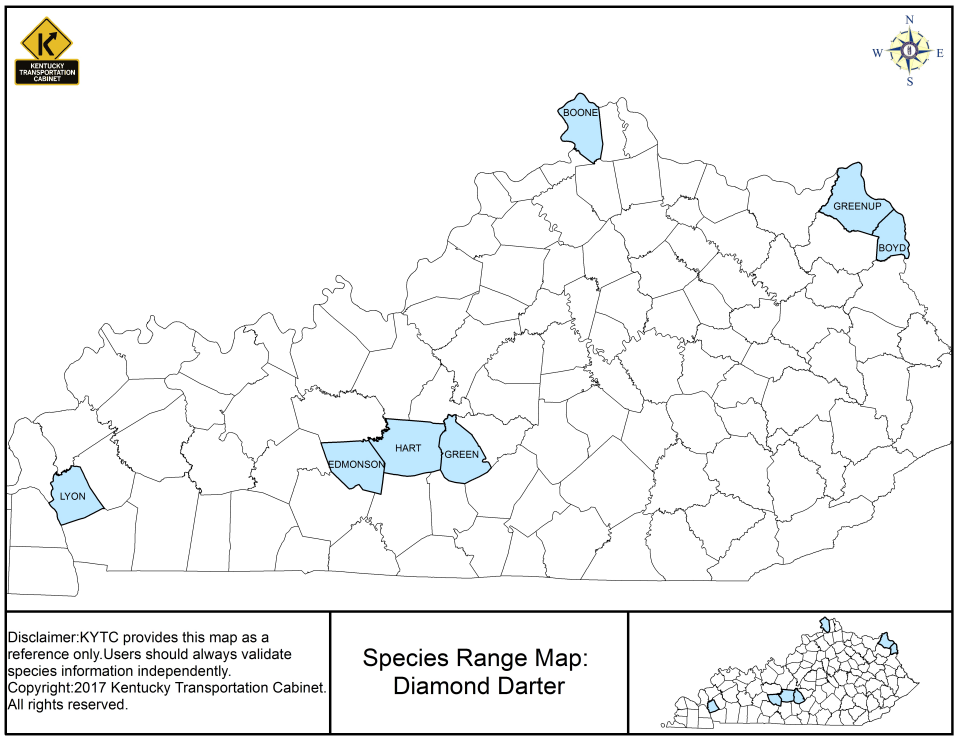
## Critical Habitat

Roughly 95 miles of the Green River in Hart, Green, and Edmonson Counties have been designated as critical habitat because it represents the best remaining historically occupied habitat for future diamond darter reintroductions. Specifically, critical habitat Unit 2 (Green River) is located from Roachville Ford near Greensburg (River Mile 294.8) downstream to the end of Cave Island in Mammoth Cave National Park (River Mile 200.3). Although currently considered to be unoccupied by diamond darter, between 1890 and 1929 diamond darters were recorded from three locations within Unit 2: adjacent to Cave Island in Edmonson County, and near Price Hole and Greensburg in Green County.



## Range

Historically, the diamond darter was found throughout the Ohio River Basin including the Muskingham River, Ohio River, and the Green River. This species is currently known to exist only within the lower Elk River drainage in Kanawha and Clay Counties, West Virginia.




## Decision Key

1) Does the project include any direct or indirect effects to the Green River in Hart, Green, or Edmonson Counties (e.g. remove riparian vegetation, alter stream banks, change water levels/flow, dredge, construct/remove bridge piers)?

    a. Yes: Contact SME
    b. No: Prepare NE finding

## Literature Cited

U.S. Fish and Wildlife Service, 2010. Diamond Darter, *Crystallaria cincotta*. https://www.fws.gov/northeast/pdf/DiamondDarter_1010.pdf

U.S. Fish and Wildlife Service. 2013. Endangered Species Status for the Diamond Darter, Final Rule. *Federal Register* 78: 45074–45095.

U.S. Fish and Wildlife Service. 2013. Designation of Critical Habitat for the Diamond Darter (*Crystallaria cincotta*), Final Rule. *Federal Register* 78: 52363–52387.

# Kentucky Arrow Darter (*Etheostoma spilotum*)

AKA: Cumberland Plateau Darter
Formerly known as: *E. sagitta spilotum*


Tagged Kentucky arrow darters at Conservation Fisheries, Inc. facility, Knoxville, TN. Photo credit: Kentucky Department of Fish and Wildlife Resources

## Species Description

Kentucky arrow darter (*Etheostoma spilotum*) was listed as **threatened** with a special **4(d) rule** on November 4, 2016.

A member of the Perch family (*Percidae*), darters are native only to freshwater streams in North America east of the Rocky Mountains. Kentucky arrow darter is a rather large darter reaching 116 mm (4.6 in) total length. It has a slender body, elongated snout, large mouth, and virtually scaleless head. The coloration is mainly straw yellow to pale greenish, and the back is crossed with 5 to 7 weak dorsal saddles, some of which may fuse with the 8 to 11 vertical lateral blotches. *E. sagitta* subspecies are difficult to distinguish between, but are separable based on various scale counts. Their diet consists predominately of larval insects, but also includes copepods and crayfishes.


Adult male Kentucky arrow darter (*Etheostoma sagitta spilotum*) at a Conservation Fisheries, Inc. facility, Knoxville, TN. Photo credit: Kentucky Department of Fish and Wildlife Resources

Kentucky arrow darters can tolerate moderate siltation, but heavy siltation and acid runoff (commonly associated with coal mining activities) are likely reasons for elimination of Kentucky arrow darter populations in eastern Kentucky.

Kentucky arrow darters spawn in spring or early summer. During this time, the males can possess brilliant colors, while the females remain pale straw yellow with grayish markings.

## Habitat Description

Kentucky arrow darter is a native species that is distributed only throughout the upper Kentucky River basin. Darters are often present in the swift-flowing sections of clear, rocky streams, and spend most of their time beneath or between rocks to protect them from the flow of the currents. This species occurs in slow to moderate current in cool, sluggish pools or areas above and below riffles over bedrock, rubble, cobble, and pebble, substrate that is often interspersed with sandy areas. Kentucky arrow darters are mostly present in upland creeks and streams, generally in headwaters, but can also be found using large streams as travel corridors.

Kentucky arrow darter is common only in 1st – 3rd order streams (most often 2nd order) and prefers habitat along banks, ledges and recesses at stream margins which provide stone areas where it can be better protected. Stream conductivity, the measure of water's capability to pass electrical flow that increases as the concentration of dissolved solids increases (e.g. salts, heavy metals), is a limiting factor for its suitable habitat. Freshwater streams supporting quality fisheries range from 50 -500 microSiemens/ per centimeter (µS/cm), and significantly decline as conductivity increases. Studies of Kentucky arrow darter show its ideal habitat conditions at < 250 µS/cm; however, due to potential fluctuation of conductivity readings we have chosen a more conservative number for use in our Decision Key (< 450 µS/cm).

Species commonly associated with Kentucky arrow darter habitat include creek chub (*Semotilus atromaculatus*), central stoneroller (*Campostoma anomalum*), white sucker (*Catostomus commersonii*), emerald darter (*Etheostoma baileyi*), rainbow darter (*E. caeruleum*), fantail darter (*E. flabellare*), and Johnny darter (*E. nigrum*).

Human-related activities in the upper Kentucky River basin that cause stream degradation can be threats to Kentucky arrow darter habitat. Such activities may include coal mining, silviculture, agriculture, gas/oil well exploration, human development, and inadequate sewage treatment. Common adverse impacts include inputs of dissolved solids and elevation of instream conductivity, sedimentation, removal of riparian vegetation, bank erosion and channel instability, inputs of untreated sewage, and agricultural runoff.

## Critical Habitat

Yes (*See more detailed information and maps provided after the decision key*)

In 2016, the USFWS designated 38 units as critical habitat in Breathitt, Clay, Harlan, Jackson, Knott, Lee, Leslie, Owsley, Perry, and Wolfe Counties, KY.

The designation of the critical habitat area is limited to the stream channel (areas within the ordinary high-water mark).

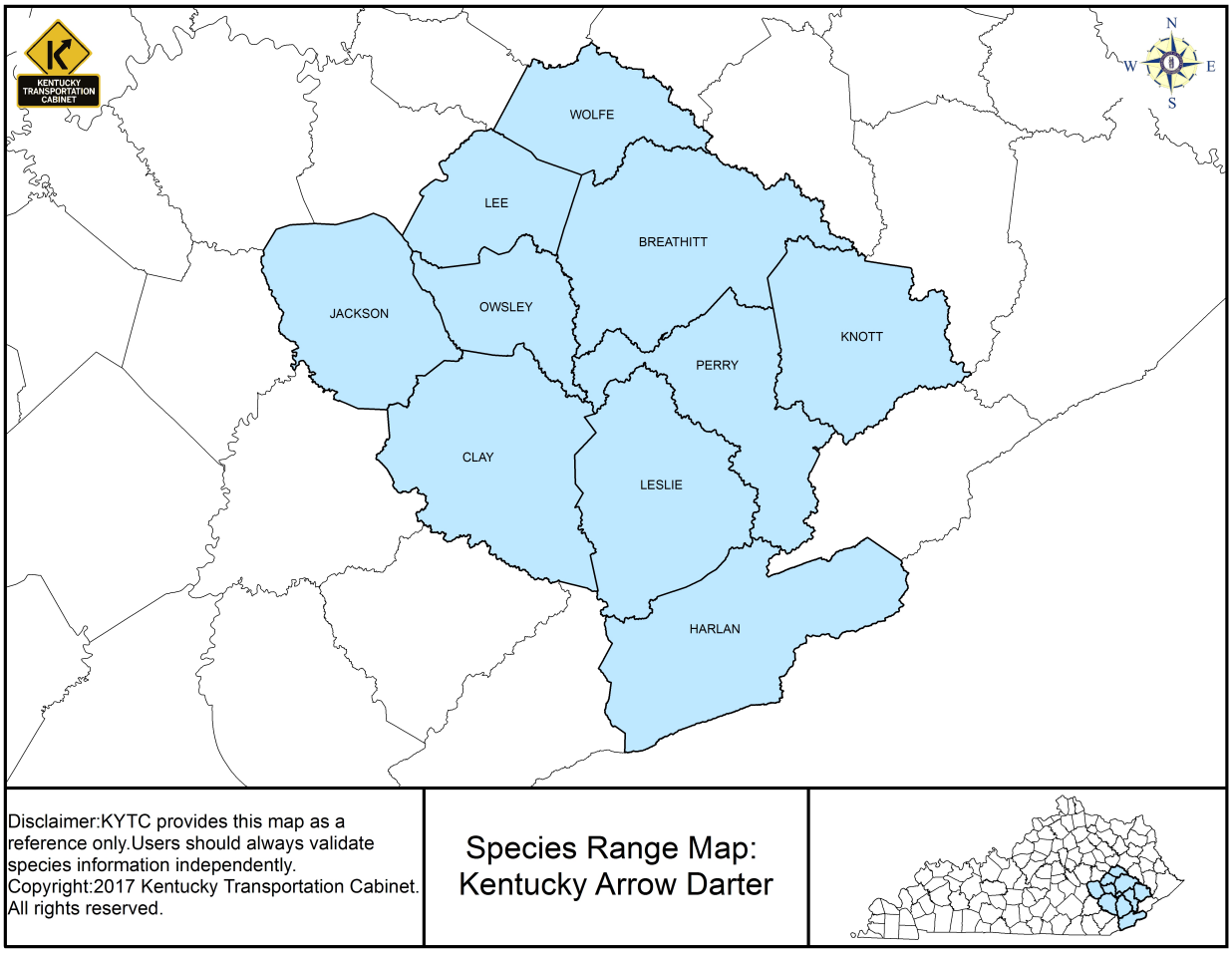
**Photo Credit: Travis Brown, Eco-Tech Consultants, Inc.**

Primary constituent elements of critical habitat for this species include:

1) Riffle-pool complexes and transitional areas (glides and runs) of geomorphically stable, first- to third-order streams of the upper Kentucky River drainage with connectivity between spawning, foraging, and resting sites to promote gene flow through the species' range.
2) Stable bottom substrates composed of gravel, cobble, boulders, bedrock ledges, and woody debris piles with low levels of siltation.
3) An instream flow regime (magnitude, frequency, duration, and seasonality of discharge over time) sufficient to provide permanent surface flows, as measured during years with average rainfall, and to maintain benthic habitats utilized by the species.
4) Adequate water quality characterized by seasonally moderate stream temperatures (generally $\leq$ 24 °C or 75 °F), high dissolved oxygen concentrations (generally $\geq$ 0.6 mg/L), moderate pH (generally 6.0 to 8.5), low stream conductivity (species' abundance decreases sharply as conductivities exceed 261 µS/cm and species is typically absent above 350 µS/cm), and low levels of pollutants. Adequate water quality is defined for the purpose of this rule as the quality necessary for normal behavior, growth, and viability of all life stages of the Kentucky arrow darter.
5) A prey base of aquatic macroinvertebrates, including mayfly nymphs, midge larvae, blackfly larvae, caddisfly larvae, stonefly nymphs, and small crayfishes.

## Range

Kentucky arrow darter is a native species that is distributed throughout Kentucky. The Kentucky arrow darter can be found in portions of the upper Kentucky River basin in eastern Kentucky including the five sub-basins: Red River (Rockbridge Fork of Swift Camp Creek), Sturgeon Creek, South Fork Kentucky River, Middle Fork Kentucky River, and North Fork Kentucky River. Currently, this species is listed for 10 counties in eastern Kentucky.



## Special 4(d) Rule

With a threatened status, a special rule can be issued under Section 4(d) of the Endangered Species Act. The US Fish and Wildlife Service has authorized certain species-specific exemptions for the Kentucky arrow darter that may be appropriate to promote the conservation of this species, which include:

1) Channel reconfiguration or restoration projects that create natural, physically stable, ecologically functioning streams (or stream and wetland systems) that are reconnected with their groundwater aquifers.
2) Bank stabilization projects that use bioengineering methods specified by the Kentucky Energy and Environment Cabinet and the Kentucky Transportation Cabinet.
3) Bridge and culvert replacement/removal projects that remove migration barriers (e.g. collapsing, blocked, or perched culverts) or generally allow for improved upstream and downstream movements of Kentucky arrow darters.
4) Repair and maintenance of U.S. Forest Service (USFS) concrete plank stream crossings in the Daniel Boone National Forest (DBNF).

If elevation of status to 'endangered' is later necessary, these exemptions would no longer apply.

## Decision Key

1) Does the project occur near any of the designated critical habitat units?

    a. Yes: Contact SME.
    b. No: Continue to Step 2.

2) Does the project include any direct or indirect effects to perennial or intermittent streams or their nearby tributaries? (e.g. – remove riparian vegetation, alter stream banks, change water levels/flow, dredge, construct/remove bridge piers, etc.)

    a. Yes: Continue to Step 3.
    b. No: Prepare NE finding.

3) Is the stream a 1$^{st}$ to 3$^{rd}$ order stream?

    a. Yes: Continue to Step 4.
    b. No: Prepare NE finding.

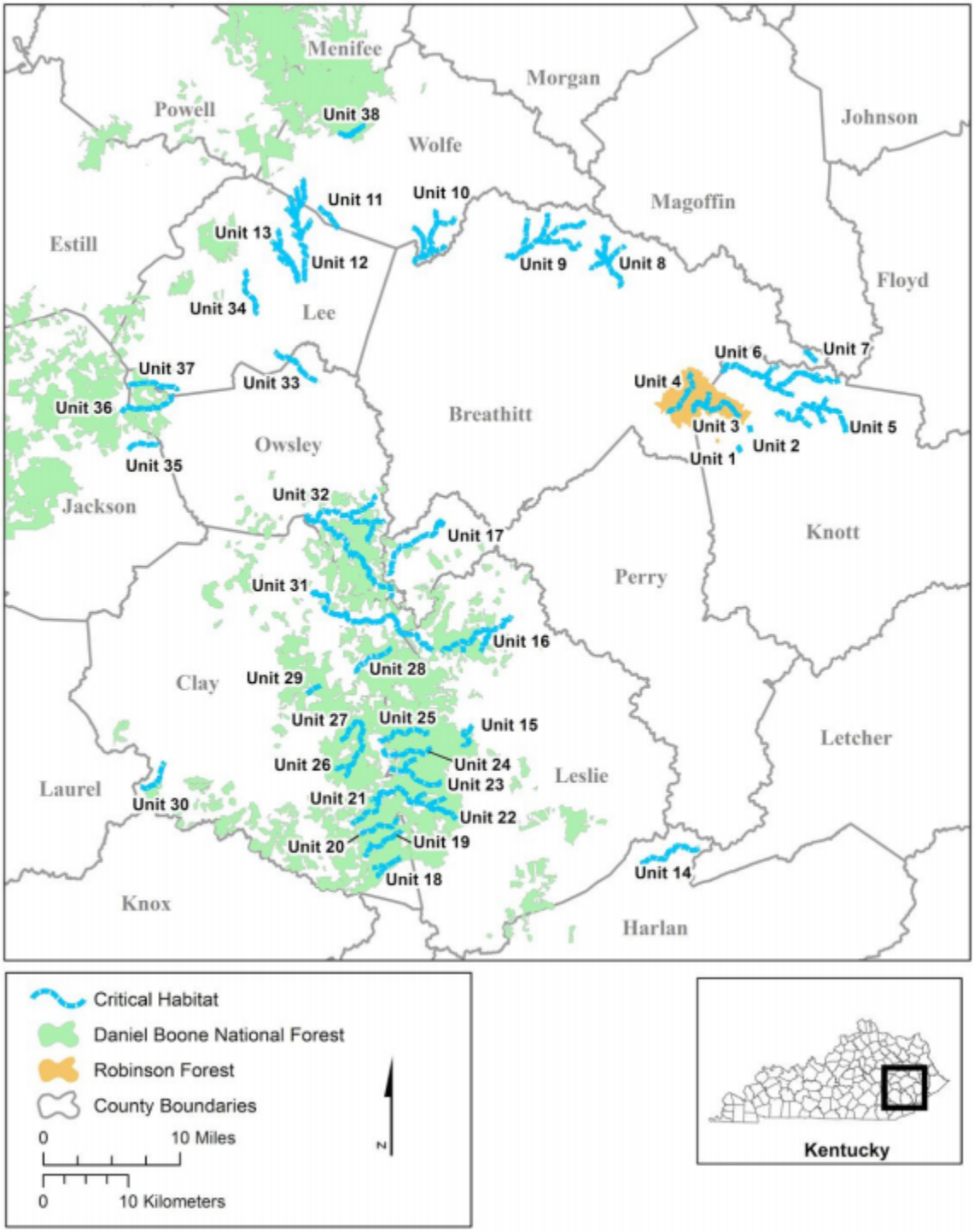
4) Measure the electrical conductivity (E.C.) of the stream waters. Is the E.C. $\leq$ 450 µS/cm?
    *Note: Be sure to walk upstream to your sampling location so that additional sediment is not disturbed.*
    ** Note: E.C. measurements can vary dependent on season and time since last rain event. Be sure to sample during typical stream conditions and <u>not</u> directly after a rain event. Taking readings in multiple locations (i.e. upstream and downstream of a bridge replacement) may be preferred.**

    a. Yes: Contact SME.
    b. No: Prepare NE finding.

## Designated Critical Habitat

| Critical Habitat Unit | County (KY) | Land Ownership | Total Length (stream miles) |
|---|---|---|---|
| 1. Buckhorn Creek and Prince Fork | Knott | Private | 0.7 |
| 2. Eli Fork | Knott | Private | 0.6 |
| 3. Coles Fork and Snag Ridge Fork | Breathitt/Knott | State | 6.8 |
| 4. Clemons Fork | Breathitt | Private/State | 4.4 |
| 5. Laurel Fork Quicksand Creek and Tributaries | Knott | Private | 12.4 |
| 6. Middle Fork Quicksand Creek and Tributaries | Knott | Private | 15.6 |
| 7. Spring Fork Quicksand Creek | Breathitt | Private | 1.4 |
| 8. Hunting Creek and Tributaries | Breathitt | Private | 9.7 |
| 9. Frozen Creek and Tributaries | Breathitt | Private | 16.4 |
| 10. Holly Creek and Tributaries | Wolfe | Private | 11.5 |
| 11. Little Fork | Lee/Wolfe | Private | 2.3 |
| 12. Walker Creek and Tributaries | Lee/Wolfe | Private | 15.5 |
| 13. Hell Creek and Tributaries | Lee | Private | 7.4 |
| 14. Big Laurel Creek | Harlan | Private | 5.7 |
| 15. Laurel Creek | Leslie | Private/Federal | 2.6 |
| 16. Hell For Certain Creek and Tributaries | Leslie | Private/Federal | 9.8 |
| 17. Squabble Creek | Perry | Private | 7.5 |
| 18. Blue Hole Creek and Left Fork Blue Hole Creek | Clay | Federal | 3.5 |
| 19. Upper Bear Creek and Tributaries | Clay | Private/Federal | 4.3 |
| 20. Katies Creek | Clay | Private/Federal | 3.5 |
| 21. Spring Creek and Little Spring Creek | Clay | Private/Federal | 5.7 |
| 22. Bowen Creek and Tributaries | Leslie | Private/Federal | 8.5 |
| 23. Elisha Creek and Tributaries | Leslie | Private/Federal | 5.9 |
| 24. Gilberts Big Creek | Clay/Leslie | Private/Federal | 4.5 |
| 25. Sugar Creek | Clay/Leslie | Private/Federal | 4.5 |
| 26. Big Double Creek and Tributaries | Clay | Federal | 6.4 |
| 27. Little Double Creek | Clay | Federal | 2.1 |
| 28. Jacks Creek | Clay | Private/Federal | 3.7 |
| 29. Long Fork | Clay | Federal | 1.4 |
| 30. Horse Creek | Clay | Private/Federal | 3.1 |
| 31. Bullskin Creek | Clay/Leslie | Private/Federal | 13.5 |
| 32. Buffalo Creek and Tributaries | Owsley | Private/Federal | 23.8 |
| 33. Lower Buffalo Creek | Lee/Owsley | Private | 4.6 |
| 34. Silver Creek | Lee | Private | 3.9 |
| 35. Travis Creek | Jackson | Private | 2.5 |
| 36. Wild Dog Creek | Jackson/Owsley | Private/Federal | 5.1 |
| 37. Granny Dismal Creek | Lee/Owsley | Private/Federal | 4.3 |
| 38. Rockbridge Fork | Wolfe | Federal | 2.8 |
| **Total** | --- | --- | **247.8** |

**Index Map:Critical Habitat for Kentucky Arrow Darter (*Etheostoma spilotum*)**




More detailed maps of these critical habitat units is available in the full Federal Registrar here: https://www.gpo.gov/fdsys/pkg/FR-2016-10-05/pdf/2016-23539.pdf

## Literature Cited

Branson, B.A. and D.L. Batch. 1972. Effects of strip mining on small stream fishes in east-central Kentucky. Proceedings of the Biological Society of Washington. 84:507-518.

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U.S. Fish and Wildlife Service. 2013. U.S. Fish and Wildlife Service Species Assessment and Listing Priority Assignment Form. Kentucky Arrow Darter (*Etheostoma sagitta spilotum*). 'Continuing Candidate'. Information current as of: April 18, 2013. http://eco.fws.gov/docs/candidate/assessments/.

U.S. Fish and Wildlife Service. 2016. Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for Kentucky Arrow Darter. Final rule. 81 FR 69312-69363.

U.S. Fish and Wildlife Service. 2016. Endangered and Threatened Wildlife and Plants; Threatened Species Status for Kentucky Arrow Darter with 4(d) Rule. 81 FR 68963-68985.

# Palezone Shiner (*Notropis albizonatus*)


Photo Credit: http://www.outdooralabama.com

## Species Description

The palezone shiner was listed as **endangered** in 1993.

This small fish reaches about two inches in length and possesses a translucent, straw-colored body with a dark mid-lateral stripe. Occupying short river reaches coupled with relatively short life spans makes Palezone shiners especially vulnerable to toxic chemical spills and short-term or localized habitat alterations.

## Habitat Description

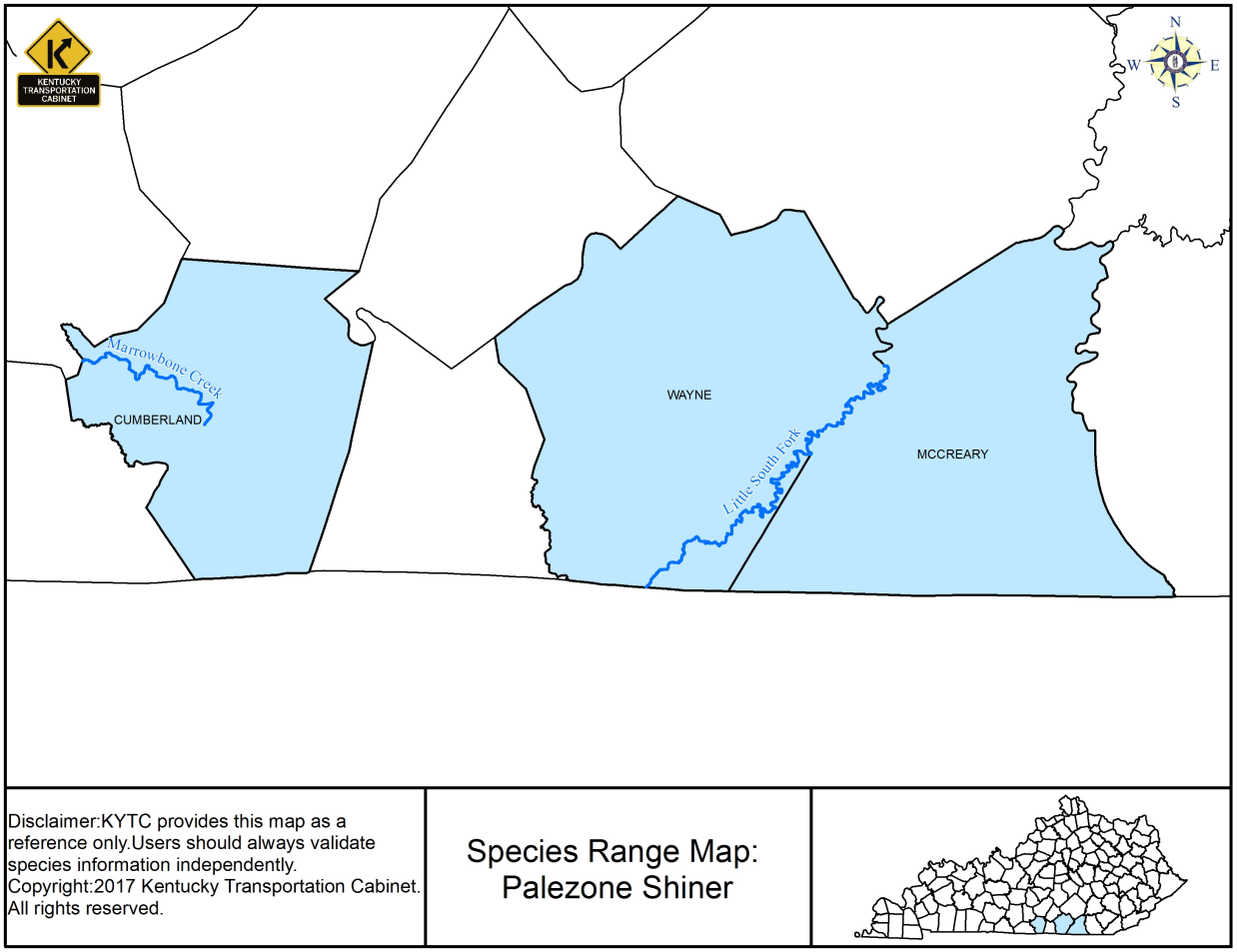
Palezone shiners (prefer flowing, shallow pools) inhabit flowing pools and runs of upland streams that have permanent flow with the following characteristics of large creeks and small rivers: clean, clear water, substrates of bedrock, cobble, pebble, and gravel mixed with sand. They have been found in swift moving pools or runs in depths ranging from 12–18 inches.

## Critical Habitat

None

## Range

The Palezone shiner is currently only found in the Little South Fork Cumberland River and Paint Rock River in Alabama. It was formerly found in Marrowbone Creek in Cumberland County, Kentucky but is considered extirpated.




## Decision Key

1) Does the project have direct or indirect effects in the stream reaches of the Little South Fork Cumberland River (e.g. remove riparian vegetation, alter stream banks, change water levels/flow, dredge, construct/remove bridge piers)?

    a. Yes: Contact SME
    b. No: Prepare NE Finding

## Literature Cited

U.S. Fish and Wildlife Service. 1993. Determination of endangered status for the duskytail darter, Palezone shiner and pygmy madtom. *Federal Register* 58(79): 25758-25763.

# Pallid Sturgeon (*Scaphirhynchus albus*)

## Species Description


Photo Credit: http://www.fws.gov

The pallid sturgeon was listed as **endangered** in 1990.

Sometimes called the dinosaur of the fish world, the pallid sturgeon has a flattened, shovel-shaped snout and a long and slender tail. These fish are armored with lengthwise bony plates instead of scales.

## Habitat Description

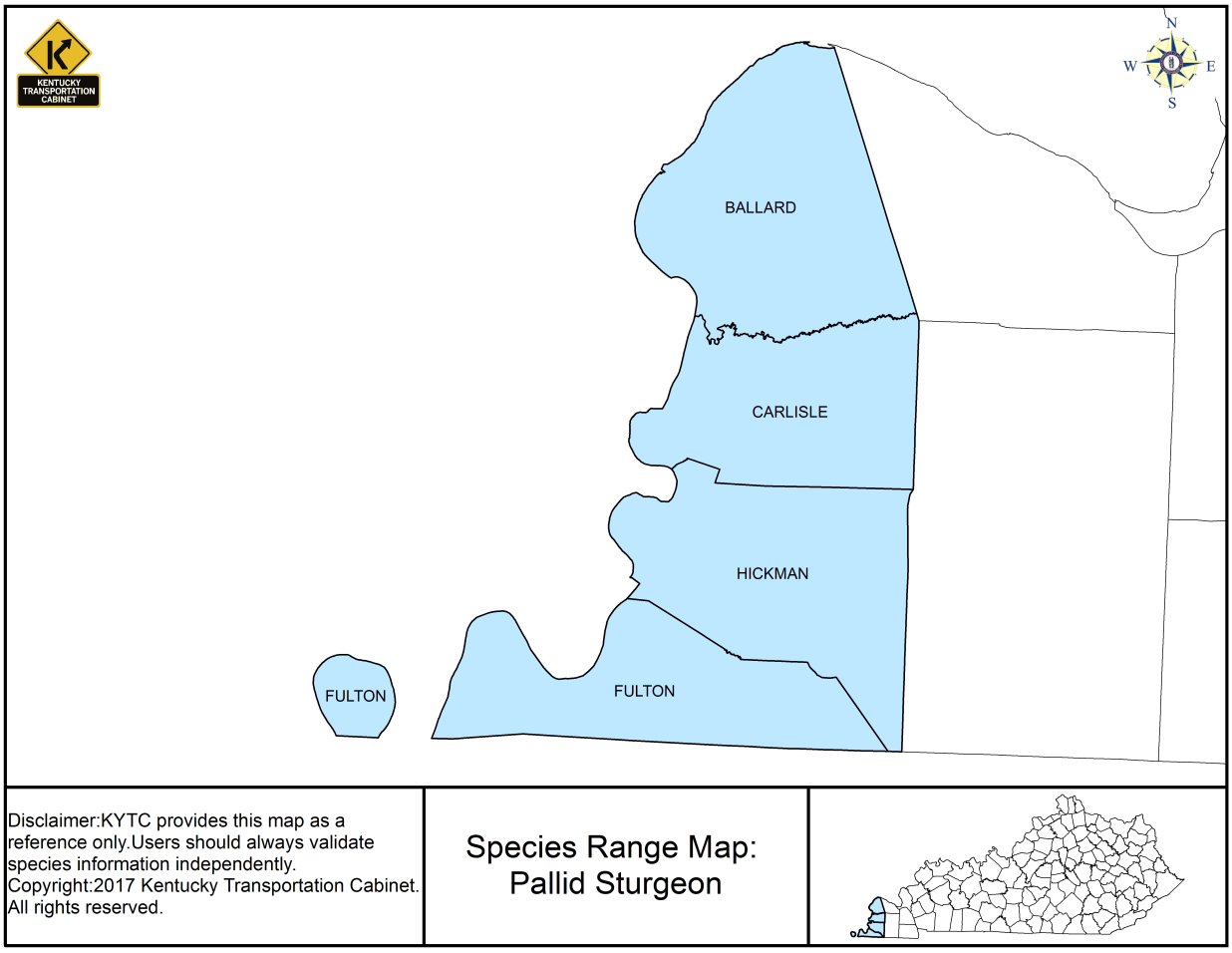
Pallid sturgeons require large, turbid, free-flowing riverine habitat with rocky or sandy substrate.

## Critical Habitat

None

## Range

This fish is found primarily in the Missouri River and the Mississippi River downstream of the junction with the Missouri River (although it has been found as far north and west as Montana).




## Decision Key

1) Does the project include any direct or indirect effects to the Mississippi River?

    a. Yes: Contact SME
    b. No: Prepare NE Finding

## Literature Cited

U.S Fish and Wildlife Service. 1990. Determination of Endangered Status for the Pallid Sturgeon. *Federal Register* 58: 25758–25763.

# Relict Darter (*Etheostoma chienense*)

## Species Description

The relict darter was listed as **endangered** in 1993.

This small perch can reach sizes up to 2.5 inches. Females and non-breeding males have light tan-colored backs and sides, with brown mottling and 6–8 dark brown saddles, and white undersides. Breeding males possess gray to dark brown sides and backs with light tan undersides.

## Habitat Description

The relict darter occurs in headwater streams and larger creeks in quiet, gently flowing pools, with a substrate of gravel mixed with sand. Cobble-size slabs, submerged sticks, and logs in either pools or riffles may play a role in spawning. Stream characteristics also include depths of 1–12 inches and widths of 9–45 feet. Riparian vegetation is typical because it provides stream bank stabilization.

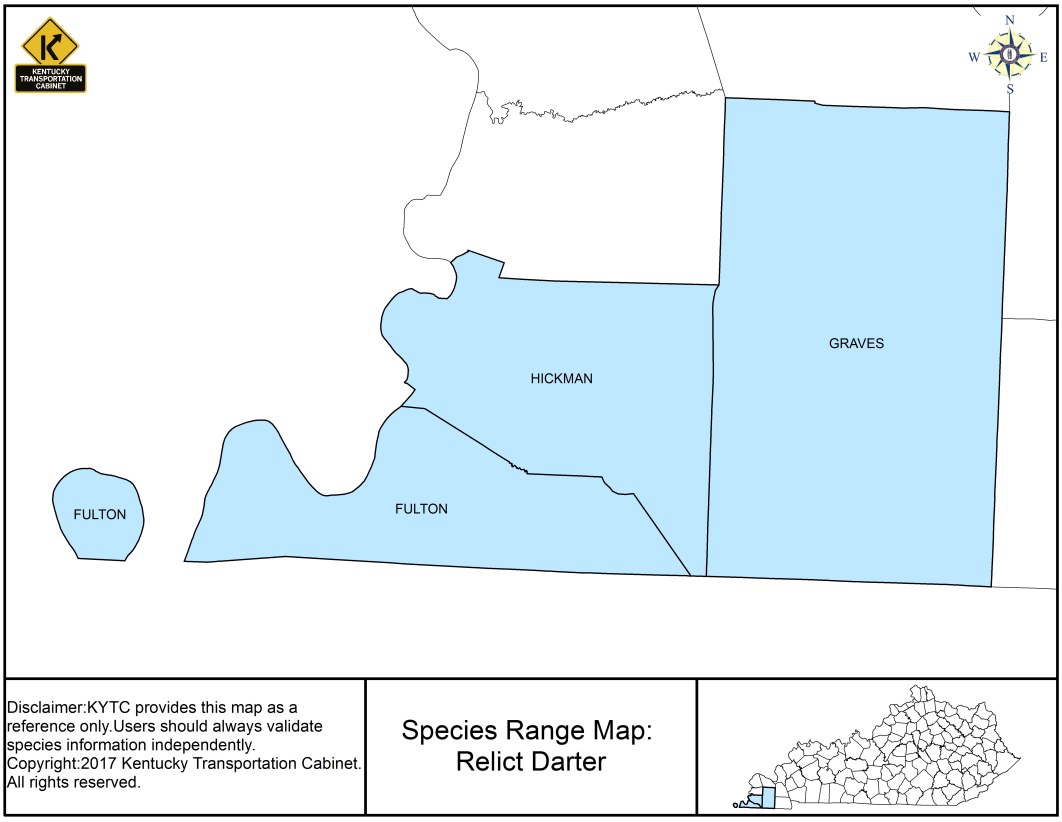
## Critical Habitat

None

## Range

Historically, relict darters were present throughout the Bayou de Chien system, the main stem and its tributaries, but now may be limited to the upper portion of the creek system in Graves and Hickman Counties, although it is still listed in Fulton County.

*See attached 11x17 map for more detailed layout of the Bayou de Chien drainage area.*




## Decision Key

1) Does the project include any direct or indirect effects to streams, including the Bayou de Chien and all its tributaries, within the Bayou de Chien drainage system in Graves, Fulton, and Hickman Counties (e.g. remove riparian vegetation, alter stream banks, change water levels/flow, dredge, construct/remove bridge piers)?

    a. Yes: Contact SME
    b. No: Prepare NE finding

## Literature Cited

U.S. Fish and Wildlife Service. 1993. Determination of Endangered Status for the Relict Darter and Bluemask (=Jewel) Darter. *Federal Register* 58: 68480-68486. Print.

KENTUCKY TRANSPORTATION CABINET

N W E S

KENTUCKY
Clinton
HICKMAN CO
FULTON CO
Hickman
South Fulton
GRAVES CO
WEAKLEY CO
Moore Island
Obion Creek
Whayne Branch
Hurricane Branch
Bayou de Chien
Sand Creek
Rond Branch
Cane Creek
Brush Creek
Barn Creek
Jackson Creek
Rush Creek
Little Mud Creek
Mud Creek
Snapneck Creek
Cub Branch
N Reelfoot Creek
Hicks Branch
Fort Bayou de Chien
JULIAN M. CARROLL PURCHASE PKY
S THOMPSON ST
307
780
239
1529
51
924
45
309
94
105
125
166
1648
215

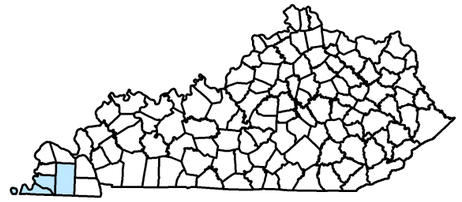
USGS The National Map: National Boundaries Dataset, National Elevation Dataset, Geographic Names Information System, National Hydrography Dataset, National Land Cover Database, National Structures Dataset, and National Transportation Dataset; U.S. Census Bureau - TIGER/Line; HERE Road Data

## Legend

- Bayou de Chien Watershed
- Watershed Boundary
- KY Counties

# Species Range Map:Relict Darter (Bayou de Chien Watershed)

Disclaimer:KYTC provides this map as a reference only.
Users should always validate species information independently.

# Tuxedo Darter (*Etheostoma lemniscatum*)

Formally split from duskytail darter (*Etheostoma percnurum*)

## Species Description


Photo Credit: http://conservationfisheries.org

The tuxedo darter was listed as **endangered** in 1993 (as the duskytail darter).

In 2008, the duskytail darter (*E. percnurum*) identification was further refined and resulted in a total of four morphologically distinct species. One of those four species is the tuxedo darter (*E. lemniscatum*), a morphologically distinct species of duskytail darter and the only variety found in Kentucky. Although the tuxedo darter is now considered its own species, its listing information within the Federal Registrar documents is still grouped under the duskytail darter. Thus, all Federal Registrar determinations/guidance regarding duskytail darter also apply directly to the tuxedo darter species.

This small fish can reach lengths up to 2.25 inches during its two years of life. Both males and females have dull coloration: the top of the head is gray, the belly is white, and their sides have vertical lines becoming less apparent towards the tail.

## Habitat Description

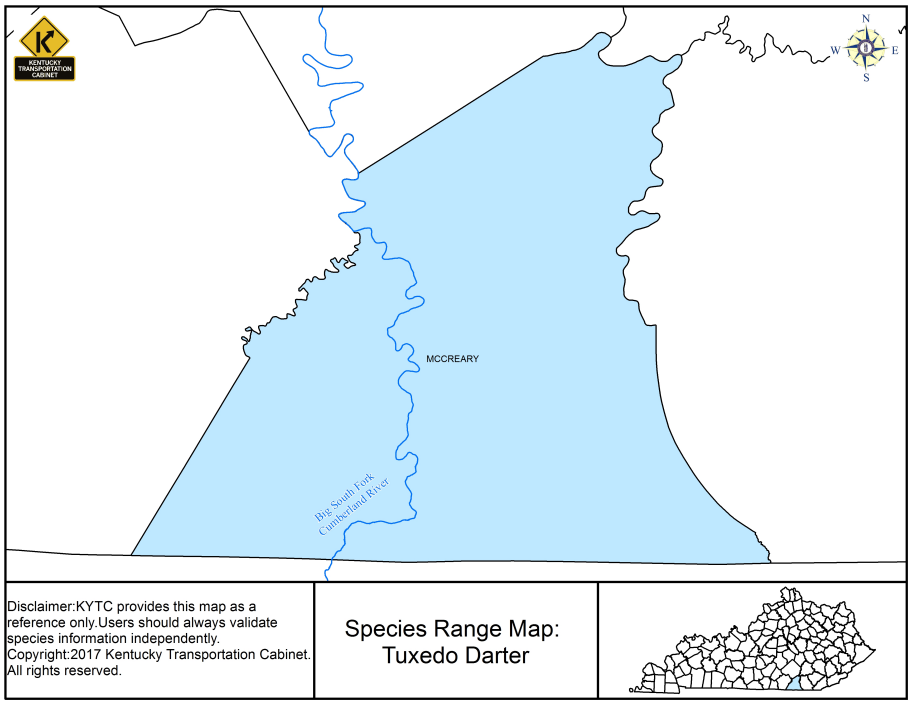
Preferred habitats for the tuxedo darter include gravel, rubble, and slab rock pools and runs of medium sized rivers (e.g. larger tributary reaches of the Cumberland) with very little silt where it inhabits the edges of gently flowing shallow pools, eddy areas, and runs in large creeks and moderately larger rivers that are 32–260 ft. wide.

## Critical Habitat

None

## Range

The tuxedo darter is limited to the Big South Fork Cumberland River including the lower reaches of the larger tributaries of the Big South Fork Cumberland River itself.




## Decision Key

1) Does the project include any direct or indirect effects to Big South Fork or the lower reaches of its larger tributaries (e.g. remove riparian vegetation, alter stream banks, change water levels/flow, dredge, construct/remove bridge piers)?

    a. Yes: Contact SME
    b. No: Prepare NE finding

## Literature Cited

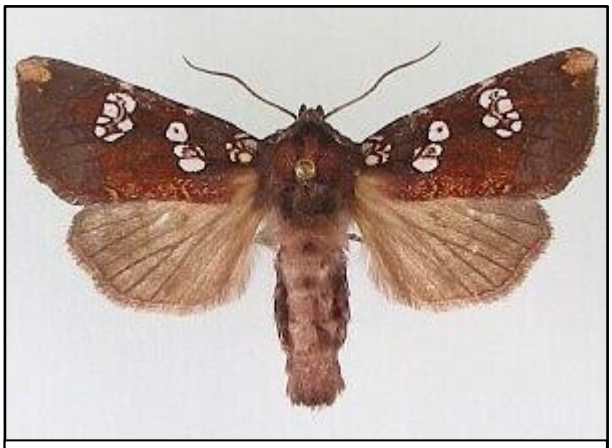
U.S. Fish and Wildlife Service. 1993. Determination of endangered status for the duskytail darter, Palezone shiner and pygmy madtom. *Federal Register* 58(79): 25758-25763.

U.S. Fish and Wildlife Service. 1999. Duskytail Darter (*Etheostoma percnurum*). http://www.fws.gov/northeast/virginiafield/pdf/endspecies/fact_sheets/duskytail%20darter.pdf.

# Rattlesnake Master Borer Moth (*Papaipema eryngii*)

## Species Description

In August 2013, the rattlesnake master borer moth was determined to be warranted for listing under the Endangered Species Act; however, due to higher priority listing species, the rattlesnake master borer moth was added to the **Candidate** list.



© Jim Wiker
North American Moth Photographer Group

The adult rattlesnake master borer moth measures 3.5–4.8 centimeters (cm) (1.4–1.9 inches). It has a smooth head with simple antennae and a tufted body. The forewing is rich purple brown to red brown becoming lighter and showing yellow powderings near the inner margin, a yellowish white dot at the base, and a powdery yellow patch at the apex. The middle of the forewing contains several distinct white and yellow spots. The hind wing is duller than the forewing and is described as smoky fawn overlaid with dark purplish powderings becoming darker at the margin.
Male rattlesnake-master borer moths have distinctively identifiable genitalia, which allow distinction from other Papaipema moths of similar appearance. Rattlesnake master borer moth larvae develop in five instars, all of which have a yellowish head and are deep purplish brown with longitudinal white lines that are broken over the first four abdominal segments.

The rattlesnake master borer moth was named after its only food source, the rattlesnake master plant (*Eryngium yuccifolium*). Adults are nocturnally active from September through October and stay relatively close to their host plants during that time. Their eggs are laid and overwinter in leaf litter. In the spring, larvae emerge, feed on the rattlesnake master plants, and eventually bore into the stems and roots of their host plant. The moth burrows until late summer when it pupates and emerges as an adult again in mid-September.

## Habitat Description

Rattlesnake master borer moths are obligate residents of undisturbed mesic prairies, woodland openings, and associated wetlands that contain the rattlesnake-master plant (*Eryngium yuccifolium*), their only larvae host and food source.

Photo Credit: pkflandscape.com Plant Gallery

Although this plant can be common in remnant prairies, rattlesnake-master occurs in low densities; is a conservative species, and has been found to have relative frequencies in restored and relict prairies of less than 1 percent.

The range of the rattlesnake master plant covers much of the eastern United States and spans from Minnesota, south to Texas, east to Florida, and back north to Connecticut. Although the plant has an expansive range, the loss of its tallgrass prairie habitat within that area is estimated to be between 82–99 percent. Most prairie destruction occurred between 1840 and 1900, but also still continues in today's time.

Photo Credit: Jim Rathert,
Missouri Department Conservation,
https://nature.mdc.mo.gov

Most high-quality prairies that remain are small and scattered across the landscape. In 1997, Robertson et al. (1997) cited the Illinois Natural Areas Inventory, which found that of the 253 grade A and B (high-quality) prairies that were identified, 83 percent were smaller than 10 acres (4 hectares) and 30 percent were smaller than 1 acre (0.4 hectares).

## Critical Habitat

None

## Range

The rattlesnake master borer moth is currently known to occur in five States: Illinois, Arkansas, Kentucky, North Carolina, and Oklahoma. Given that its food plant ranges across 26 States (USDA Plants website 2017, http://plants.usda.gov), it is likely the rattlesnake master borer moth's historical range was larger than at present; however, not much data supports its presence in other Midwest states. For Kentucky, this moth species is only known in **Hardin County**.

## Decision Key

1) Is the project in prairie type habitat (i.e. – unforested with tall and/or short grass species dominant on the landscape) and/or have the rattlesnake master plant present?

   If YES: contact SME
   If NO: conclude with a No Effect finding

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# Rusty Patched Bumble Bee (*Bombus affinis*)

## Species Description


Photo Credit: Dan Mullen via USFWS Website

Rusty patched bumble bee (*Bombus affinis*) was listed as **endangered** on January 11, 2017. The effective date for the final rule to list the rusty patched bumble bee as endangered was delayed to March 21, 2017.

Rusty patched bumble bees are a ground-nesting, colonial species that reproduce in an annual cycle. In spring, solitary females emerge and find nest sites, collect nectar and pollen from flowers and begin laying eggs, which are fertilized by sperm stored since mating the previous fall. These first eggs will hatch establishing the colony which will include a single queen and female workers. Males and new queens are produced and hatched in late summer. Males disperse to mate with new queens from other colonies. In fall, founding queens, workers and males die. Only new queens go into diapause (a form of hibernation) over winter, and the cycle begins again in spring.

Illustrations of a rusty patched bumble bee queen (left), worker (center), and male (right).
By Elaine Evans, The Xerces Society.

## Habitat Description

The rusty patched bumble bee is a generalist forager (gathers pollen and nectar from a wide variety of flowering plants) but requires a constant supply and diversity of flowers blooming throughout the colony's long life, April through September. It emerges in spring and is one of the last species to go into hibernation in fall.

Their nests are typically in abandoned rodent nests or other similar cavities. Little is known about the overwintering habitat of rusty patched bumble bee foundress queens, but other species of *Bombus* typically form a chamber in soft soil, a few centimeters deep, and sometimes use compost or mole hills to overwinter.

The rusty patched bumble bee has been observed and collected in a variety of habitats, including prairies, woodlands, marches, agricultural landscapes, and residential parks and gardens. The species requires areas that support sufficient food, undisturbed nesting sites in proximity to floral resources, and overwintering sites for hibernating queens. Healthy populations of the rusty patched bumble bee may include tens to hundreds of colonies. The health of bumble bee populations depends on the quantity and quality of available nectar and pollen, the proximity of flowering plants to nest sites, and the spatial relationship between established colonies (to help maintain genetic diversity).

## Critical Habitat

None

## Range

Prior to the mid to late 1990s, the rusty patched bumble bee was widely distributed across areas of 31 States/Provinces: Connecticut, Delaware, District of Columbia, Georgia, Illinois, Indiana, Iowa, Kentucky, Maine, Maryland, Massachusetts, Michigan, Minnesota, Missouri, New Hampshire, New Jersey, New York, North Carolina, North Dakota, Ohio, Ontario, Pennsylvania, Quebec, Rhode Island, South Carolina, South Dakota, Tennessee, Vermont, Virginia, West Virginia, and Wisconsin. Since 2000, the rusty patched bumble bee has been reported from 14 States/Provinces: Illinois, Indiana, Iowa, Maine, Maryland, Massachusetts, Minnesota, North Carolina, Ontario, Ohio, Pennsylvania, Tennessee, Virginia, and Wisconsin. The current distribution represents this species being reduced to only 8% of its historical extent.

Although this species is currently protected under the Endangered Species Act regulations, in 2017 there are currently no known populations extant within Kentucky. There are 11 counties in Kentucky that fall within the historical range for the rusty patched bumble bee (Bath, Boyd, Carter, Elliott, Fleming, Lawrence, Lewis, Martin, Menifee, Morgan, and Rowan).

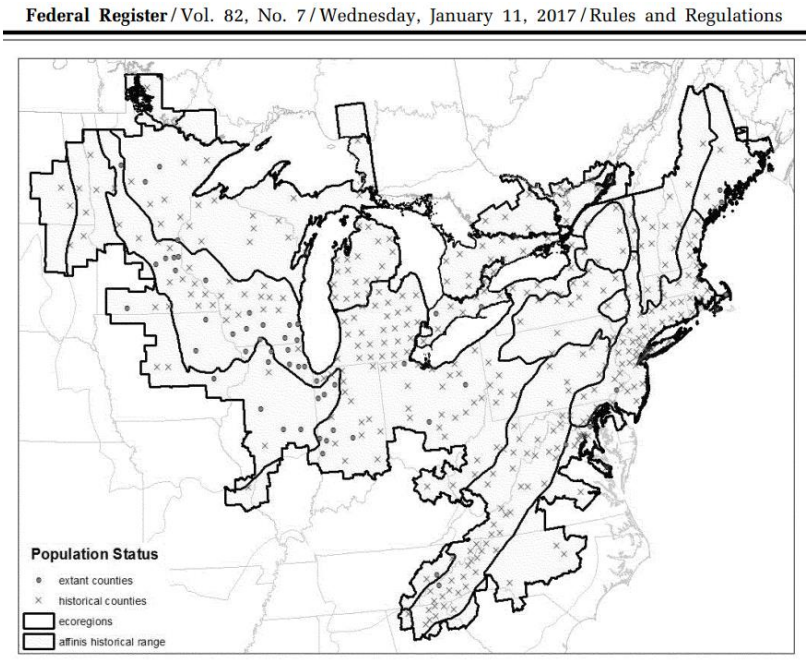
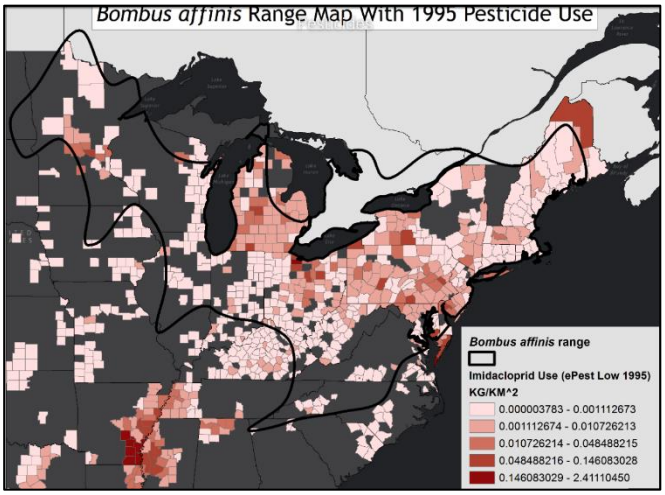


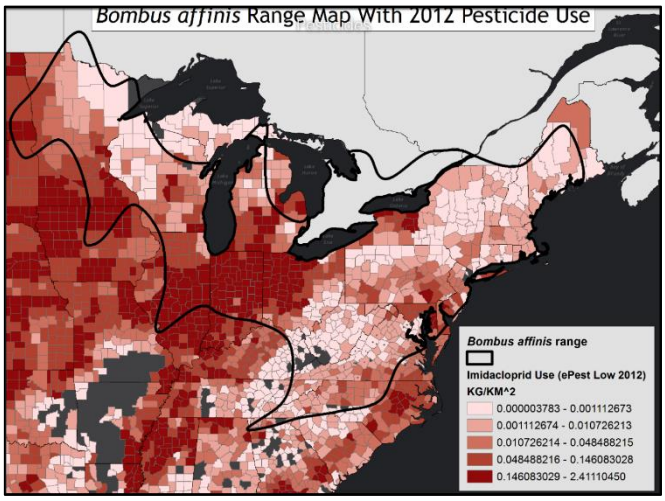

**Figure 1**. Rusty patched bumble bee range map showing the current distribution. Dots represent counties with a rusty patched bumble bee occurrence since 2000. The Xs represent counties with historical occurrences only (*i.e.*, no occurrences since 2000). (See Szymanski *et al.* (2016, p. 12) for an explanation of current and historical time periods.)

## Current Threats

1) Disease: Although evidence for chronic spillover of disease-causing organisms (i.e. bacteria, fungi or viruses) from commercial bumble bees remains debatable, diseases can be detrimental to the health foundress queens and entire colonies.

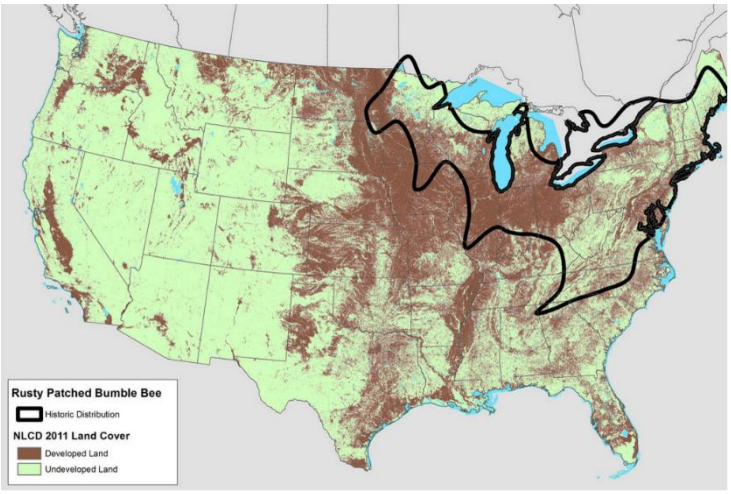
2) Pesticides: Pesticides are widely used in agricultural, urban and even natural settings and can include products such as insecticides, fungicides, herbicides and the chemicals added to pesticides to improve application or other properties. Insecticides intend to target invertebrate species and are usually non-discriminant between 'pollinators' and 'pests'. One particular insecticide that has received much attention in regards to impacts on bee species is neonicotinoids. Neonicotinoid use rapidly increased when suppliers began selling pre-treated seeds. This insecticide is effective because the chemical persists from the pre-treated seed, through the plant, and into its nectar and pollen. Pollinators foraging on treated plants are then directly exposed to these chemicals and can carry them back to expose the rest of their colony as well. Although it is extremely rare for KYTC to apply insecticides, KYTC does use herbicide application in order to reduce and control invasive and undesirable plant species within our right-of-ways. Although herbicides target plants and do not impact bumble bees directly, the overall loss of flowering plants can reduce or eliminate available flowers that bumble bees need for pollen and nectar.



3) Climate Change: The changes in climate most likely to have effects on bumble bees include increased drought, increased flooding, increased storm events, early snow melt, late frost, and increased variability in temperatures and precipitation. These may impact bee food supply (plant flowering seasons), nesting habitat (impacts to rodent populations or increase in storms/flooding), stress from overheating (higher temperatures), and pressures from pathogens and non-native/invasive plants and animals.

4) Habitat Loss and Degradation: Field 'weeds', fencerows, field borders, and roadsides once provided some flowering plants for bumble bee foraging. Current trends towards more intensive agriculture and an increase of monoculture plantings no longer provides this diversity of flowering plants.



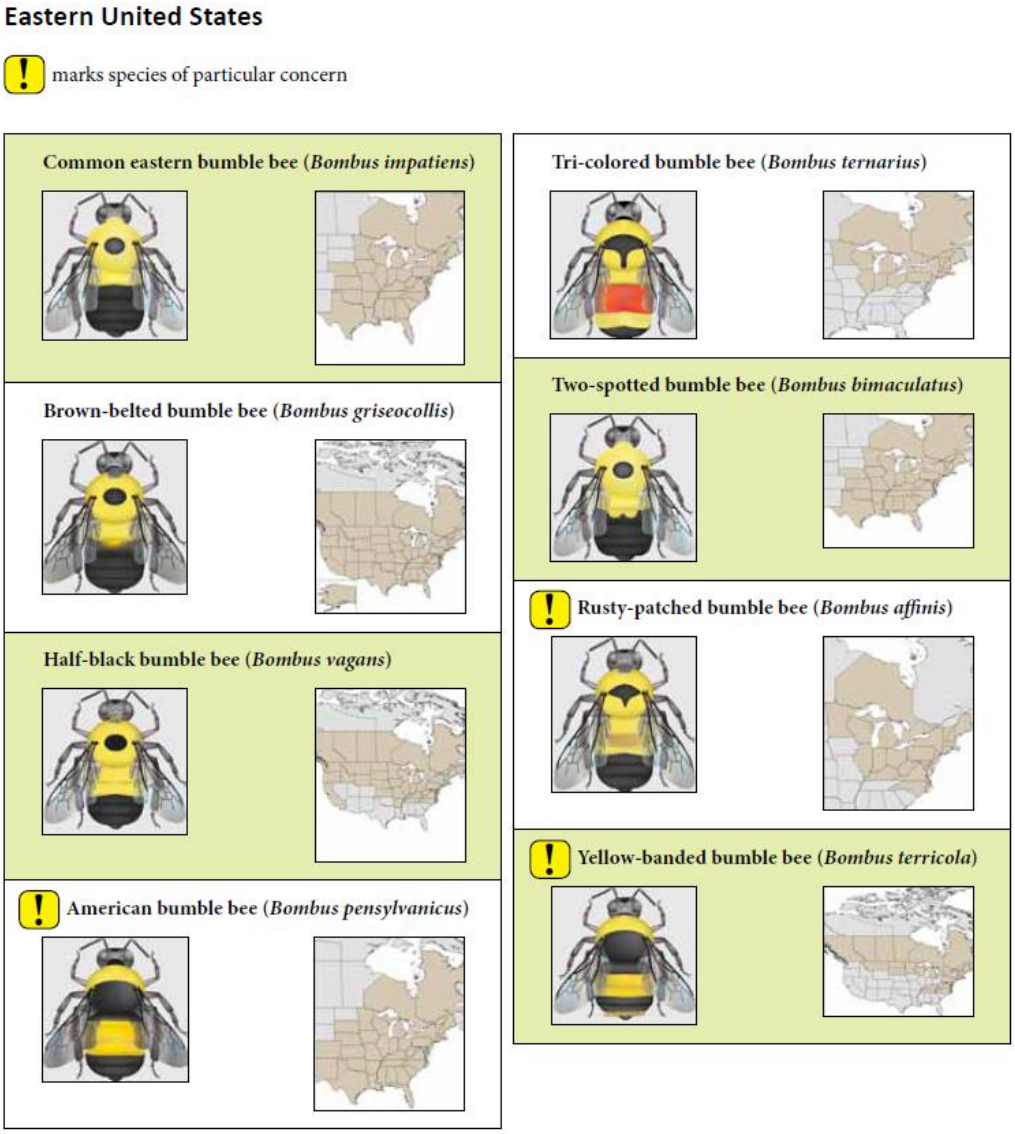

5) Small Population Dynamics: Most populations considered to be current were documented by only a single or few individuals found during surveys (only two surveys >10 individuals). These small counts accompanied with its reproductive strategies leave this species vulnerable to the effects of small population size. Increased chances of inbreeding of related individuals likely also increases the proportion of sterile males produced.

## Decision Key

*** No rusty patched bumble bee populations are currently known within the state of Kentucky. The historic range of this species does overlap some areas of Districts 9, 10 and 12. Survey efforts are not currently required for any projects in Kentucky. If you have concerns about this species or have any opportunities to help promote pollinators (habitat plantings, land management improvements, etc.) please contact your SME Biologist for assistance.

## Additional Information

The rusty patched bumble bee is just one of approximately 47 bumble bee species found in North America. , The Xerces Society figure below points out a few of the bumble bee species native to the Eastern United States and flags some of the species whose statuses are of particular concern at this time.



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# Extirpated Insect Species

## American Burying Beetle (*Nicrophorus americanus*)

### Species Description

American burying beetle (*Nicrophorus americanus*) was listed as **endangered** in July 1989.


Photo Credit: U.S. Fish and Wildlife Service

American burying beetle is a large (1-1.5 inches), nocturnal carrion beetle that is active from April through September. It can be distinguished from other beetles by the large orange-red pronotal disk (the area on the upper back below the head) and the two pairs of red spots on the black elytra (wing covers). The adults feed on a broad range of carrion and will also capture and consume live insects. A pair of beetles will utilize a carcass, preferably one that weighs between 3.5 and 7.0 oz., but can utilize smaller ones down to 1.2 oz., (large mouse) in which to lay eggs. The pair buries the carcass before dawn, removes the fur or feathers in the process, and coats the body with secretions that retard decay. Eggs are laid in a chamber next to the carcass and one parent, usually the female, stays with them until the larvae complete their development. The adults tend the developing larvae by feeding on the carcass and regurgitating the flesh where the larvae can feed on it. The number of larvae that area successful is directly related to the carcass size. Once the larvae have reached their maximum growth they pupate in the soil near the brood chamber and emerge as adults in 48 to 60 days.

## Habitat Description

The habitats used by this species is variable and relies on availability of carrion more than the location of vegetation type present in an area. They have been found in pasture, open riparian woods, oak-pine and oak-hickory woodlands. The few descriptions of these woodlands sites have had an open understory. Wooded or grassland sites that are not heavily grazed or burned can build-up a detritus layer which also supports good small mammal and bird populations that are a good carrion source for these beetles. Areas that have very dry, thin, rocky soils, very wet soils, and very sandy soils are not suitable for carcass burial.

## Critical Habitat

None

## Range

This was a widespread species in the eastern United States prior to the 1920's and was found in at least 150 counties in 35 states. It currently ranges from an island in the Atlantic off the coast of Rhode Island to the short grass prairie of Nebraska and Oklahoma. The American Burying Beetle is currently known only to six states: Arkansas, Kansas, Nebraska, Oklahoma, Rhode Island, and South Dakota. There are historical records from five counties in Kentucky (Fayette, Henderson, Henry, Jefferson, and Trigg) four from the 1920's, and the most recent record from Trigg County in 1974. Due to the lack of records in recent history, the U.S. Fish and Wildlife-Kentucky Field Office currently considers this species to be extirpated from the state of Kentucky.

## Decision Key

*** This species is considered to be extirpated from the state of Kentucky by the U.S. Fish and Wildlife Service – Kentucky Field Office. No survey or additional review is required; prepare a no effect form that discusses the status of this species.

## Literature Cited

U.S. Fish and Wildlife. 1991. American Burying Beetle (*Nicrophorus americanus*) Recovery Plan and Life History. http://www.fws.gov/endangered/.

University of Nebraska State Museum, Division of Entomology. http://www.museum.unledu/research/entomology/endanger.htm.

# Basic Introduction to Bats

Bats are of the mammalian order Chiroptera and the only true flying mammals. Kentucky is home to sixteen documented bat species and fourteen permanent resident species. Although fruit bats are present in other areas of North America, all Kentucky bat species are insectivores. Bats use echolocation for night travel are the only major predator of night flying insects. Some bat species have been noted to eat as many as 600 mosquitos in an hour. With this large consumption, bats play a vital role in control of the insect population and related disease.

Bats are known carriers for the rabies virus; although transferal to humans is actually rarer than from other species more frequently encountered, such as raccoons. However, it is also notable that bats' small bones are delicate and unnecessary handling of bats should be avoided. Additionally, handling of any bat species that are provided federal protections under the Endangered Species Act requires both a state and federal permit.

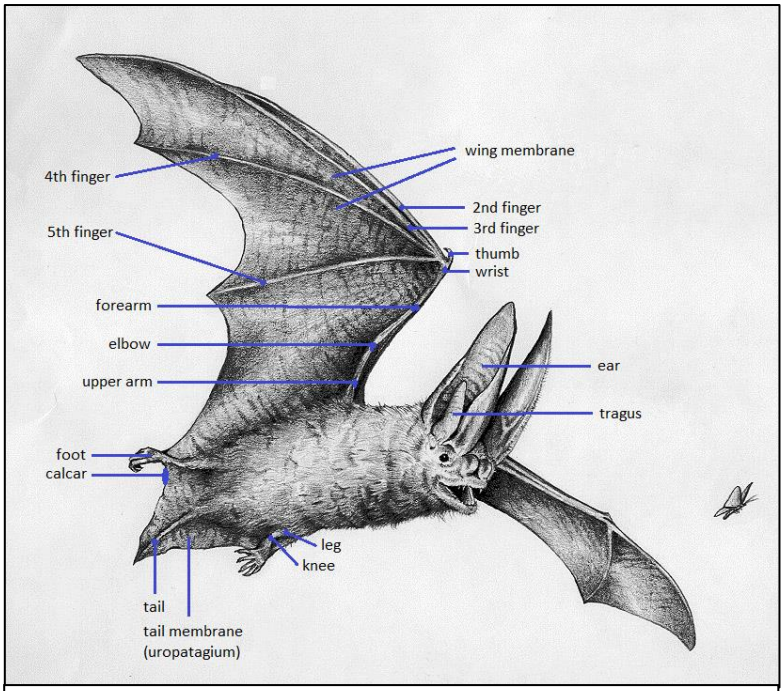


Illustration by Rick Hill, KDFWR (acquired from fw.ky.gov)

Four of Kentucky's bats are provided federal protections under the Endangered Species Act:

- **gray bat** (*Myotis grisescens*),
- **Indiana bat** (*Myotis sodalis*),
- **northern long-eared bat** (*Myotis septentrionalis*),
- **Virginia big-eared bat** (*Corynorhinus townsendii virginianus*).

The gray, Indiana, and northern long-eared bats are considered potentially present statewide in Kentucky. The Virginia big-eared bat has a more localized range within eastern Kentucky and is considered present in eighteen counties. More detailed range mapping is provided in each species' review section, following this Introductions to Bats section.

## White Nose Syndrome

One of the most notable threats to bats is currently White nose syndrome (WNS). WNS was named for the white fungus observed around the muzzles, ears, and wing membranes of affected bats; but was later identified as the previously unknown, cold-loving fungus *Geomyces destructans* (formerly known as *Pseudogymnoascus destructans*) that thrives in low temperatures and high humidity. Although it was first observed in New York during winter 2006/2007, WNS was not found within Kentucky until 2011 (Figure 1). In Kentucky, WNS was first observed inside a Trigg County cave, but the fungus has since spread throughout the state and continues to affect hibernating bats. This fungus does not cause direct mortality of bats, but instead disrupts their hibernation by prompting them to wake to clean themselves, and ultimately depleting their winter fat reserves.

Each bat species has slightly different preferences or habits, so some species have been more heavily impacted by the presence of WNS than others. For example, gray bats have not exhibited the same mortality rates as other Myotis species; although some gray bats have been confirmed as infected with WNS. As of 2017, two of Kentucky's larger bodied, big-eared bat species [Rafinesque's big-eared bat (*Corynorhinus rafinesquii*) and Virginia big-eared bat] have not been seen infected by WNS; there is hope that studying these species' survival will help researchers develop more information on how to combat the spread of WNS.

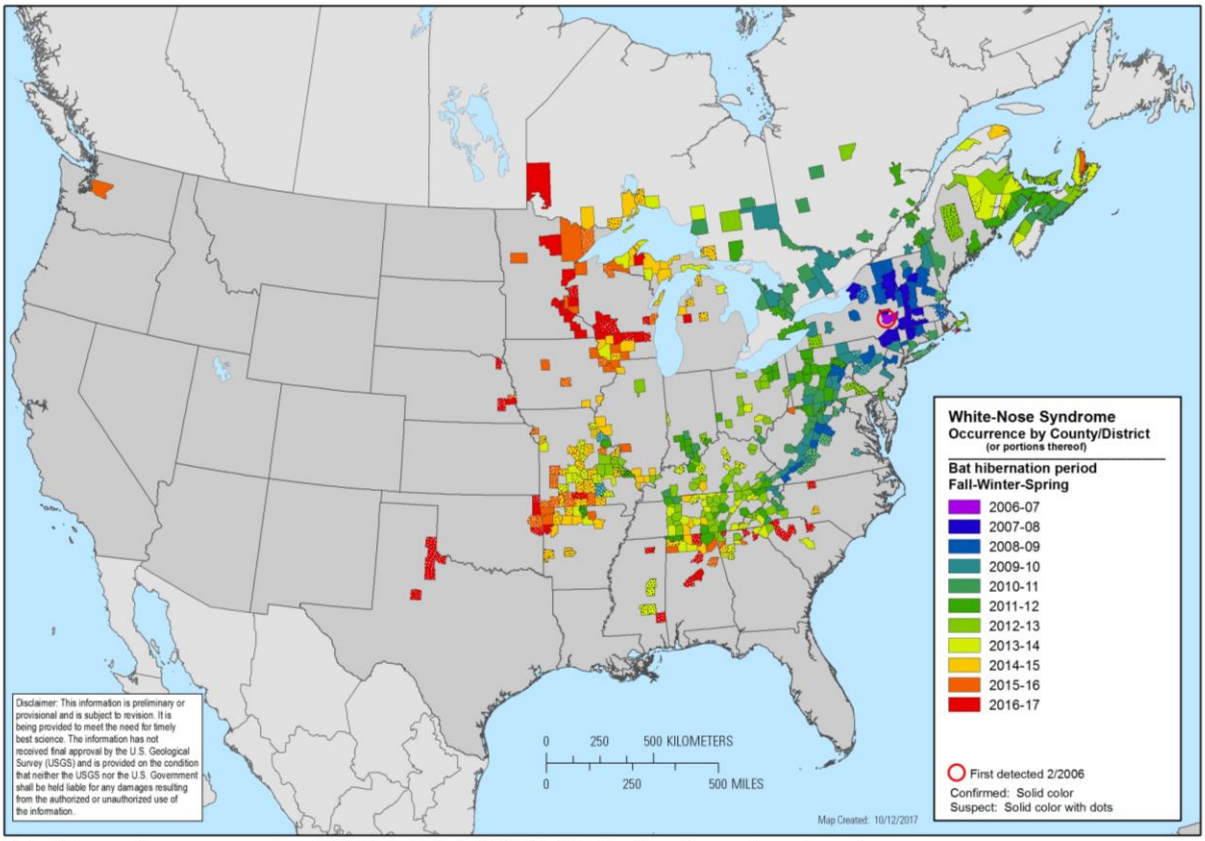


**Figure 1.** White nose syndrome occurrences in the United States by county and year.

## Bat Habitat

Bats travel across the landscape to forage for food. Many of the insects often have aquatic larval stages, so foraging along open stream corridors is relatively common. Other potential foraging habitats can include places like upland forested areas and open fields.

Each bat species has slight to significant differences in behavior and habitat preferences. Overall, Kentucky bat species can be relatively well described in two major categories: cave-dwelling bats and forest-dwelling bats. Additionally, bats can also be found using man-made structures such as bridges or buildings.

### *Cave-Dwelling Bats*:

Cave-dwelling bats roost year-round in caves and cave-like features (hibernacula) such as portals, abandoned mines, and/or rockshelters. Although these bats do exhibit site fidelity, they also will travel across the landscape and can roost at numerous different sites throughout the year, often based on variance of structure characteristics such as size, temperature, or humidity. Examples of cave-dwelling species include both the gray and Virginia big-eared bats.

Cave-dwelling bats swarm at the entrances of the caves in early Fall to mate before they enter caves for hibernation. Female bats have delayed fertilization, so emerge from their caves and conceive in Spring. They cluster together in the caves during summer months in maternity colonies to raise their young. These young are non-volant when born, so with their inability to fly or move June-July are particularly vulnerable months for these bat young. Compared to other small mammals, bats have an exceptionally low reproductive rate with typically only one young per year. With few young and anticipated threats (WNS, habitat loss, etc.), bats are apt to have slow population recovery rates. While females and young are clustered in their maternity colonies, male bats can be singular on the landscape or congregated in separate groups called bachelor colonies.

### *Forest-Dwelling Bats*:

Forest-dwelling bats roost in forest habitat (i.e. trees) during the Summer months but then later roost in caves and cave-like features (hibernacula) during the Winter months. Although these bats do exhibit site fidelity, they also will travel across the landscape and can roost at numerous different sites throughout the year, often based on variance of structure characteristics such as size, temperature, or humidity. Examples of cave-dwelling species include both the Indiana and northern long-eared bats.

Like cave-dwelling bats, forest-dwelling bats also swarm at the entrances of the cave in early Fall to mate before they enter caves for hibernation. Female bats have delayed fertilization, so emerge from their cave and conceive during Spring. They cluster together in forest roost

structures, which typically include live or dead (snag) trees exhibiting sloughing bark, or small cracks/crevices, during summer months in maternity colonies to raise their young. Being in the forest-setting, these sites are often focused in areas with high quality foraging potential nearby. The young are non-volant when born, so with their inability to fly or move June-July are particularly vulnerable months for these bat young; hence some tree removal restrictions during June 1 to July 31. Compared to other small mammals, bats have an exceptionally low reproductive rate with typically only one young per year. With few young and anticipated threats (WNS, habitat loss, etc.), bats are apt to have slow population recovery rates. While females and young are clustered in their maternity colonies, male bats can be singular on the landscape or congregated in separate groups called bachelor colonies.

### *Bridge/Building/Structure Roosting*:

Although bats are traditionally tied to natural cave and tree features, bats have also adapted to the introduction of humans and man-made structures on the landscape. Bats can enter holes as small as 3/8 inch diameter. With small gaps and crevices present at both bridges and buildings, it is not uncommon that bats will use these features as temporary or long-term roost sites. Of the federally protected bats, all four species have been observed using bridge structures, and the most common protected species using buildings has been the northern long-eared bat.

Bats prefer small, covered openings, which help to protect them from the weather and potential predators. It is notable that bats cannot gnaw new holes or reopen old ones. There are some ways to exclude bats from existing structures, but that must be done carefully and with guidance from a professional bat biologist who is permitted to handle federally protected species.

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# Gray Bat (*Myotis grisescens*)

## Species Description

Gray bat was listed as **endangered** on April 28, 1976.

Photo Credit: Todd McDaniel, HMB Professional Engineers, Inc.

The gray bat is a small, gray colored bat generally weighing between 7-10 grams with an average total length of between 80-105 mm. Gray bats can be distinguished from other *Myotis* species by its uniform-colored dorsal fur from base to tip and by its attachment of wing membrane at ankle, not at base of toe.

Gray bats are described as a year-round, cave-dwelling species. During the winter when their food source (primarily aquatic insects) is unavailable, gray bats hibernate (torpor) in caves (known as hibernacula) that serve as cold air traps, where they form tightly packed clusters of thousands of hibernating bats. Upon emergence from hibernation in the spring (usually March) they migrate to suitable summer cave habitat, forming maternity colonies of up to 20,000 individuals. Females give birth to a single young in late May or early June. These reproductive females use caves or cave-like habitats that trap warm air in domed ceilings and are almost always located less than 1 mile from a stream or lake. Males and non-reproductive females form colonies in less suitable caves or cave-like habitats often as far as 18-20 miles from maternity sites. In September and October the bats return to the area surrounding the hibernacula to mate, and to forage in order to build up fat reserves for the winter hibernation. Normally, the bats have entered the hibernacula by early November.

## Habitat Description

*Summer & Winter Habitat*: Gray bats use caves or cave-like habitats year-round, moving seasonally between warm and cold caves. Cave-like habitats include coal and limestone mines, large storm sewers, bridges, and tunnels. Gray bats hibernate during the winter in deep limestone caves that act as cold air traps. Very few caves meet the specific temperature requirements required for hibernating gray bats. Maternity colonies are almost always located in caves as well. During the spring and fall migration a wider variety of caves and cave-like habitats are used as roosts. Gray bats are also known to roost at bridge or culverts. These structures can provide places for bats to rest with protection from predators and adverse weather conditions.

Potential adverse impacts associated with transportation projects may include disturbance of winter or summer caves or cave-like habitats and changes to foraging areas. Construction activities such as fill, blasting, diversion of water away from or toward a cave system (which could affect access), altering of airflow or temperature regimes within the system, and altering cave passages are all potential impacts. The replacement of bridges or culverts that are being used by gray bats could result in direct mortality or at the very least habitat loss. Bridge and culvert construction can also affect stream foraging areas either through the loss of riparian habitat or the production of in-stream sediment that reduces aquatic insect production.

*Foraging Habitat*: Gray bats forage for flying insects over streams and lakes that are bordered by forest or at least have an intact riparian zone, often up to 12-15 miles from their roost. They prefer to fly through forest canopy between caves and feeding areas, traveling considerable distances out of their way to reach a foraging area, in order to take advantage of the cover provided by even scattered trees along fencerows. These travel corridors are important to connect roost sites to feeding areas. Foraging habitat is almost always over water (streams, lakes, or wetlands) with an intact, forested riparian zone. Smaller wooded stream corridors, wooded fencerows, and connecting woodlots are used as travel lanes to reach foraging areas. Ponds and lakes with some riparian zone are used to a similar degree.

Foraging habitat can be impacted through tree clearing that removes forested travel corridors that connect foraging sites to roost sites, or removes forested borders from lakes or streams. New corridor construction, widening that requires clearing, bridge replacements that require tree removal, and borrow or fill areas that are located in wooded or partially wooded areas, are all activities that could impact gray bats. Stream relocations and riparian vegetation removal can impact gray bat foraging habitat. Any cumulative impacts (changes that are likely to occur in the reasonably foreseeable future) to gray bat habitat, as a result of the project, should be considered as well.

Wetlands or reservoirs with a forested border are foraging habitat for gray bats. These bats fly along the edges of the water, under the protection of overhanging branches, and hunt for flying insects.

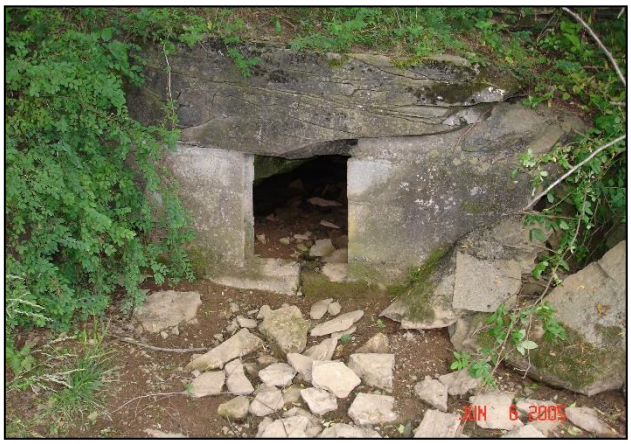

Streams with forested riparian areas are foraging habitat for gray bats. These bats fly along the edges of the stream, under the protection of overhanging branches, and hunt for flying insects. Gray bat feeding areas have not been found along sections of stream where adjacent forest has been cleared.

Particular attention should be paid along stream valley walls.

Sinkhole openings can be level with the ground, and may be hidden from view by vegetation or debris. Gray bats may still be using these partially blocked sinkhole openings.

Some cave openings may be hidden from view by vegetation or debris.

Bridges are sometimes used as roosts by gray bats. These bridges mimic cave conditions and provide a protected shelter for the bats. Most bridges used by gray bats are located over water.



Cave openings will not always have a typical, recognizable, appearance.

## Critical Habitat

None

## Range

The range of the gray bat extends from southern Illinois, Indiana, and Ohio, east to western West Virginia, Virginia, and North Carolina, south to south western Georgia, northwestern Florida, southern Alabama, and northwest Arkansas, and west to western Missouri, northeastern Oklahoma, and southeastern Kansas, encompassing all of Kentucky and Tennessee. The gray bat was listed as potentially occurring statewide in Kentucky (all counties) during 2016.

## Assessment Methods

*Office Assessment:*
Review geologic quads for karst and cave features, presence of karst bearing strata (Ordovician and Mississippian age limestone), underground quarry sites, and mine adits. Review any mapping that indicates vegetation and presence of streams and reservoirs, including aerial photography, topographic quadrangles, right-of-way strip maps, and plan sheets.

*Field Assessment:*
When on site, walk the scope of the project to locate any known openings within 1 km of the project disturbance limits and confirm their presence or absence and condition, as well as the location of any unknown openings (wildcat mines, collapsed audits, etc.). Pay particular attention to vertical clifflines adjacent to stream valleys which may have cave openings. Look for highway and railway bridges and storm sewers that have a cave-like appearance. See Figure 1 for optional KYTC bridge assessment datasheet. Current and former landowners of subject parcels are a good source of information. NOTE: *Do not enter mines or caves.*

Look for streams and reservoirs that have forested borders, as well as forested areas, like fencerows, that connect streams to caves or cave-like habitats, and verify the presence or absence of these features with an on-site visit.

**Figure 1.**

KENTUCKY BATS IN BRIDGES DATASHEET

Investigator Name(s): _____

KYTC Structure ID # _____ KYTC Project # _____

Date/Time: _____ County : _____

Lat: _____ Long: _____

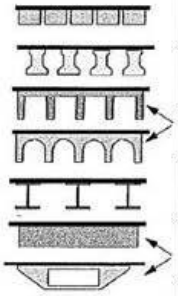
Phone: _____ Email: _____

Location: _____

Road Type and Name: (check one)

- Interstate
- U.S. Highway
- State Road
- County Road

Bridge Type: (check one)



| | |
|---|---|
| Parallel Box Beam | |
| Pre-stressed Girder | |
| Cast in Place | |
| Steel I-beam | |
| Flat Slab | |
| Other | |

Conditions under Bridge: (circle all that apply)

| | |
|---|---|
| Bare Ground | Concrete |
| Open Vegetation (not obstructing flight path) | Closed Vegetation (may obstruct flight path) |
| Flowing Water | Standing Water |
| Two Lane Road | Four (or more) Lane Highway |
| Dirt Road | Railroad |

Surrounding Habitat: (circle all that apply)

| | | | |
|---|---|---|---|
| Residential | Agriculture | Commercial | Woodland |
| Grassland | Ranching | Riparian | Mixed |

Bats Present: (circle one) YES / NO

1

**Species Present**:

| Num. | Species | Num. | Species |
|---|---|---|---|
| _____ | *Myotis septentrionalis* | _____ | *Lasiurus cinereus* |
| _____ | *Myotis sodalis* | _____ | *Lasiurus noctivagans* |
| _____ | *Myotis leibii* | _____ | *Perimyotis subflavus* |
| _____ | *Myotis lucifugus* | _____ | *Eptesicus fuscus* |
| _____ | *Myotis grisescens* | _____ | *Nycticeius humeralis* |
| _____ | *Myotis austroriparius* | _____ | Corynorhinus t. virginianus |
| _____ | *Lasiurus borealis* | _____ | *Corynorhinus rafinesquii* |
| _____ | *Lasiurus seminolus* | _____ | UNKNOWN |

**Bat indicators: (check all that apply)** **Visual** ☐ **Staining** ☐ **Sound** ☐ **Guano** ☐ **Smell** ☐

**Please submit photos of bats/sign when possible**

**Areas Inspected**:

| | | | |
|---|---|---|---|
| **Expansion joints** | ☐ | **Vertical surfaces between concrete end walls and bridge deck** | ☐ |
| **Crevices** | ☐ | **Vertical surfaces on I-beams** | ☐ |
| **Rough surfaces / spalls** | ☐ | **Guardrails** | ☐ |
| **Other:** _____ | ☐ | **Other:** _____ | ☐ |

**Areas NOT Inspected because of safety or inaccessibility**:

_____

_____

_____

**Summary Info (circle all that apply):**

| | | | |
|---|---|---|---|
| Human disturbance or traffic under bridge or at structure | **High** | **Low** | **None** |
| Evidence of bats using bird nests? | **Yes** | **No** | |

**Additional Comments: (location description, scuppers, barrier gaps)**

_____

_____

_____

_____

_____

_____

_____

## Decision Key

1) Do any of the following occur within the project area or within 1 km of the project area:
    - Limestone strata
    - Karst features (caves, sinkholes)
    - Inactive underground mining (coal, limestone)

    a. Yes: Contact SME
    b. No: Go to Step 2

2) Will the project directly impact streams with wooded banks or open water wetlands?

    a. Yes: Contact SME
    b. No: Prepare a No Effect finding

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# Indiana Bat (*Myotis sodalis*)

Photo Credit:
http://www.nrs.fs.fed.us/sustaining_forests/conserve_enhance/wildlife_fish/habitat_resource_selection/

## Species Description

The Indiana bat was listed as an **endangered** species on March 11, 1967.

The Indiana bat is a small, brown bat generally weighing between 5-11 grams with an average total length of between 75-102 mm. Its physical characteristics are similar to that of the little brown bat (*Myotis lucifugus*) and northern long-eared bat (*Myotis septentrionalis*); however, the Indiana bat is distinguished by its presence of a keeled calcar, coloration, and absence of long toe hairs.

This species uses different habitats during the summer (forest-dwelling) and winter (cave-dwelling) months. In addition, male and female bats may use different habitat types. Both sexes overwinter in caves or open mines. During late spring/early summer, female bats form maternity colonies in characteristic trees (*Habitat Description*, Figure 1). Males roost singly or in small groups in trees and small caves and require less specific roost habitat. During mid-fall the bats migrate to their winter habitat and begin the mating behavior known as swarming. Both males and females require forested areas and wetland/riparian areas for foraging.

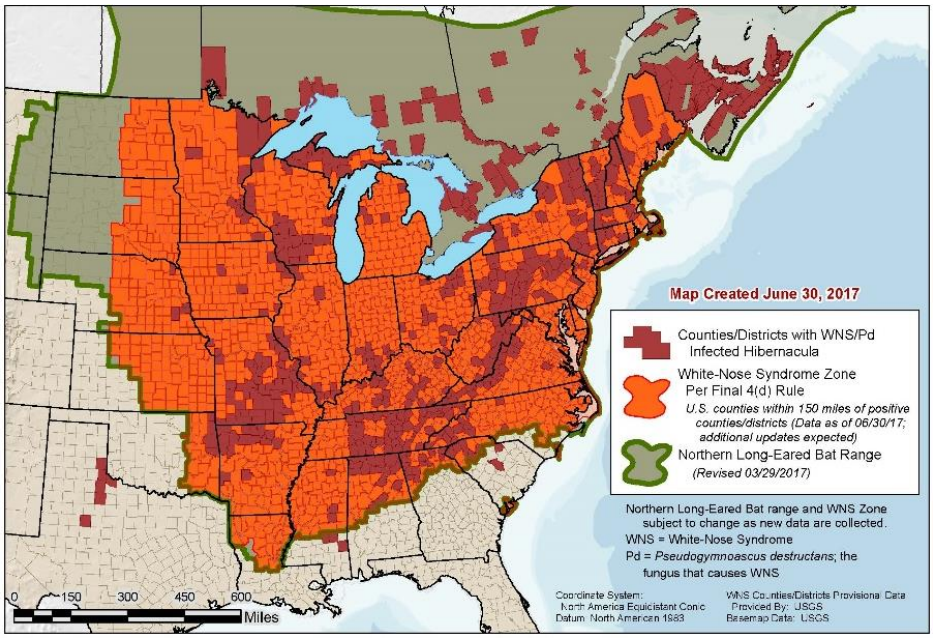
## Habitat Description

*Winter Habitat*: Caves, or deep mines (including coal and limestone as well as other mineral recovery operations) are the typical wintering habitat for Indiana bats.

Threats to the species vary with its annual cycle. At the hibernacula, threats include modifications to the caves, mines, and surrounding areas that result in changes in airflow and alteration of the microclimates in the hibernacula. Human disturbance and vandalism pose significant threats to the species during hibernation by inducing arousal and consequent depletion of fat reserves and through direct mortality. Natural catastrophes (flooding and freezing events) can also have a significant effect on the population during winter because of the large number of individuals that hibernate in a relatively few sites. The Indiana bat hibernates colonially in caves and mines in the winter. During the winter months, Indiana bats are restricted to suitable underground hibernacula typically consisting of caves located in karst areas of the east-central United States; however, this species also hibernates in cave-like locations, including abandoned mines. Hibernacula tend to have large volumes with large rooms and vertical or extensive passages, often below the lowest entrance. Cave volume and complexity help buffer the cave environment against rapid and extreme changes in outside temperature, and vertical relief helps provide a range of temperatures and roost sites. Most Indiana bats hibernate in caves or mines where the ambient temperature is relatively stable and remains below 10°C (50.0°F) but infrequently drops below freezing. In these caves, tight groups are formed that can consist of hundreds to thousands of individuals. It is generally accepted that most Indiana bats return to the same hibernaculum each year. These bats also tend to hibernate in the same cave or mine at which they swarm, although there are exceptions to this pattern. Colonization of new hibernacula has been documented, indicating that this species has some capacity to exploit unoccupied habitats and expand their winter distribution.

Cluster density may also be limiting for hibernating bats. Indiana bats roost in dense clusters in hibernacula, potentially for thermal benefits or the conservation of water. Although the link between cluster size and overwinter survival has not been quantified, there are several benefits to being a member of a large hibernating population, including the social and energetic advantages

of roosting in dense clusters, and having many individuals available during fall swarming to help ensure reproductive success.




A new threat to bats emerged in upstate New York in the winter of 2006 and has since spread far across the eastern and Midwestern U.S. Referred to as White Nose Syndrome (WNS), given the name because of the white fungal growth observed on affected bats, it is caused by the bats contracting a fungus identified as *Geomyces destructans*. In as little as four years WNS has claimed the lives of at least a million bats and infected hibernacula in the northeast, resulting in mortality rates upwards of 95 percent. It's not clearly known, but the fungus appears to disrupt bats hibernation by causing them to repeatedly awaken, thereby depleting essential fat reserves. Once the fat reserves have been depleted bats attempt to emerge early to forage and are met with unfavorable weather conditions that almost always leads to mortality.

During summer months, possible threats relate to the loss and degradation of forested habitat. Migration pathways and swarming sites can also be affected by habitat loss and degradation. Habitats surrounding swarming sites may be particularly important in that these sites are discrete areas that apparently must be suitable to support large numbers of bats that, in addition to engaging in swarming activities, must forage to build up sufficient fat reserves to sustain them through the hibernation period.

*Summer Habitat*: Indiana bat summer habitat includes any tree greater than or equal to 5" dbh that possesses any or all of the following characteristics; exfoliating bark (e.g., shagbark hickory), dead or dying trunk/limbs (species of vegetation which do not normally possess exfoliating bark can develop this characteristic as the bark dies and begins to separate from the dying trunk/branch), cavities and fissures (e.g. woodpecker holes, lightning damage, heart rot). These trees can be found in various landscapes including floodplains and bottomlands, slopes and ridges, as well as upland areas. Some representative pictures of suitable Indiana bat summer roosting habitat in Figure 1.

Primary roosts usually receive direct sunlight for more than half the day. Roost trees are typically within canopy gaps in a forest, in a fence line, or along a wooded edge. Habitats in which maternity roosts occur include riparian zones, bottomland and floodplain habitats, wooded wetlands, and upland communities.

The most likely impacts associated with transportation projects are disturbance and removal of forested summer habitat, disturbance of caves and cave-like openings, and alterations to foraging habitat. The loss of summer habitat could result in direct mortality if the area being cleared is inhabited by bats at the time of clearing. Foraging habitat can also be impacted through tree clearing that removes forested travel corridors that potentially connect foraging sites to roost sites or removes forested borders from streams or other water bodies. New corridor construction, widening of an existing roadway that requires clearing, bridge replacements that require tree removal, and excess fill areas that are located in wooded or partially wooded areas are all activities that could impact Indiana bats. Bridge and culvert construction can also affect stream foraging areas either through the loss of riparian vegetation or the production of in-stream sediment that could potentially reduce the aquatic insect production of that waterway.

Construction activities such as blasting, diversion of surface water away from or toward a cave or mine system, altering of airflow or temperature within a cave system, and altering cave or mine passages are all potential impacts to Indiana bat winter habitat.

*Foraging Habitat*: Commuting habitat that connects summer foraging and roosting areas is necessary to maximize foraging success and conserve energy. As a general rule, the Indiana bat does not cross large open areas and will follow tree lines or fencerows to reach foraging areas despite increased energy expenditures and commuting distances, although exceptions to this have been noted. Variable distances to foraging areas may be attributed to range wide differences in habitat type, interspecific competition, and landscape terrain. Fall swarming also requires the presence of suitable roost trees, foraging areas, and water in the vicinity of each occupied hibernaculum. Adequate habitat connectivity is needed to allow for movement of bats among these various elements.

Foraging habitat for both sexes is comprised of closed to semi-open forest and forest edges. There does not appear to be a preference for the type of wooded habitat, and foraging has been noted in multiple wooded habitat types including floodplain, riparian, lowland, and upland forests. Although some observations of foraging have been documented from open areas, numerous studies have shown the dominant use of wooded edge habitat over open areas.

The Indiana bat shows fidelity to summer roosting and foraging areas. Benefits of site familiarity include reduction in time spent searching for new sites, more profitable exploitation of local food resources, and greater awareness of resident predators. Whenever roosts and foraging sources are eliminated, bats are forced to seek new habitat and expand their foraging range, potentially reducing foraging success and exposing bats to increased predation and competition. Availability of traditional roosting and foraging areas, at least at the landscape level, are important to survival and productivity.

The minimum size of a forest patch that will sustain Indiana bat maternity colonies has not been established. However, in highly fragmented landscapes the loss of connectivity among forested blocks may degrade the quality of the habitat for the Indiana bat. Patterson et al. (2003) noted that the mobility of bats, associated with flight, allows them to exploit fragments of habitat. However, they cautioned that reliance on already diffuse resources (e.g., roost trees) leaves bats highly vulnerable, and that energetics may preclude the use of overly patchy habitats.

Connectivity of habitats has been demonstrated to be important to this species. Murray and Kurta (2004) noted that bats within their maternity habitat in Michigan did not fly over open fields but traveled along wooded corridors, even though use of these corridors increased commuting distance by over 55 percent. Sparks et al. (2005) also noted the importance of a wooded riparian travel corridor to the Indiana bat in the maternity colony at their study site in Indiana. In addition, the distance and wooded connectivity between roosts and foraging areas may be limiting for this species at some sites.

**Figure 1: Pictures of suitable Indiana bat roosting habitat**

## Critical Habitat

Yes

Critical habitat was designated for the species on September 24, 1976 and included 11 caves and 3 mines in six states. In Kentucky, these critical habitat designations include Bat Cave (Carter County) and Coach Cave (Edmonson County). Five of the 23 Priority 1 hibernacula identified in the Indiana bat Draft Recovery Plan (2007) lie within Kentucky's borders. Three of these hibernacula occur within the Mammoth Cave system. The two other Priority 1 hibernacula occur in Kentucky's eastern coalfields with Bat Cave in the northeast portion of the state and Line Fork Cave in the southeast.

## Range

The range of the Indiana bat includes Alabama, Arkansas, Connecticut, Florida, Georgia, Illinois, Indiana, Iowa, Kentucky, Maryland, Massachusetts, Michigan, Missouri, New Jersey, New York, North Carolina, Ohio, Oklahoma, Pennsylvania, Tennessee, Vermont, Virginia, West Virginia, and Wisconsin. Most capture records of reproductively active female and juvenile Indiana bats have occurred in the upper Midwest including southern Iowa, northern Missouri, much of Illinois, most of Indiana, southern Michigan, western Ohio, and in Kentucky. Even though the winter range is dispersed across the eastern U.S., over 90 percent of the estimated range-wide population (in 2005) hibernated in just five states: Indiana, Missouri, Kentucky, Illinois, and New York. The Indiana bat is assumed present statewide (all counties) in Kentucky.

## Habitat Assessment Methods

*Office Assessment:*
Review geologic quads for indications of potential winter habitat such as karst/cave features, presence of karst bearing strata (Ordovician and Mississippian age limestone), quarry sites, mine adits, and elevations of coal seams within 1 km of the project's disturbed limits. Review should also include accessing Energy and Environment Cabinet (EEC) Division of Mines' GIS layer for the presence of active and abandoned deep mines near the project area. Begin with best available remote-sensing data including; aerial photography, topographic quadrangles, right-of-way strip maps, plan sheets indicating vegetation, etc.

*Field Assessment:*
On-site inspections should include walking the project area (any areas that would be directly or indirectly impacted by the project) to locate potential winter and/or summer roosting habitat. Known openings identified during office assessment as well as identifying the presence of unknown openings (wildcat mines, collapsed adits, open-throat sinkholes, etc.) should be documented.

## Decision Key

1) Does the project require the removal of any tree(s) greater than or equal to 5" diameter at breast height regardless of the structure and characteristics of the tree(s)?

    a. Yes: Contact a DEA Subject Matter Expert
    b. No: Go to Step 2

2) Did survey of the project area, USGS quad, or any other resource (document all resources consulted or agency coordination undertaken) identify any of the following within 1 km of the project area?
    - Caves
    - Mine adits
    - Open throated sinkholes
    - Other karst features

    a. Yes: Contact a DEA Subject Matter Expert
    b. No: Prepare a No Effect finding

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# Northern long-eared Bat (*Myotis septentrionalis*)

## Species Description

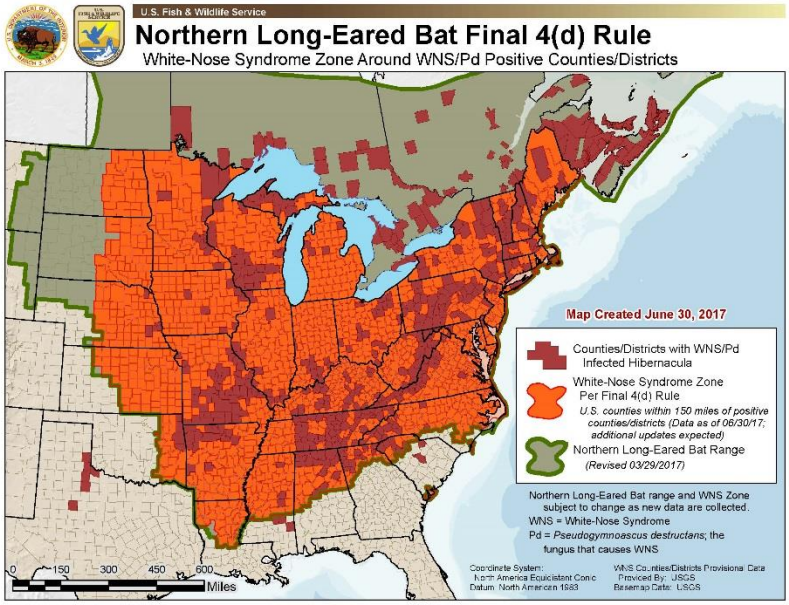
The northern long-eared bat was listed as **threatened** under the ESA on April 2, 2015, with a rule under authority of Section 4(d) of the ESA finalized on January 14, 2016.

The northern long-eared bat is a small, brown bat generally weighing 5-10 grams, with ears long enough to fold past the tip of the nose (17-19 mm). Its physical characteristics are similar to that of the little brown bat (*Myotis lucifugus*) and Indiana bat (*Myotis sodalis*); however, the northern long-eared bat is distinguished by its lack of a keeled calcar, coloration, and sparse to medium-long toe hairs.

This species uses different habitats during the summer (forest-dwelling) and winter (cave-dwelling) months. In addition, male and female bats may use different habitat types. Both sexes overwinter in caves or open mines. During late spring/early summer, female bats form maternity colonies in characteristic trees. Males roost singly or in small groups in trees and small caves and require less specific roost habitat. During mid-fall the bats migrate to their winter habitat and begin the mating behavior known as swarming. Both males and females require forested areas and wetland/riparian areas for foraging.

A new threat to bats emerged in upstate New York in the winter of 2006 and has since spread far across the eastern and Midwestern U.S. Referred to as White Nose Syndrome (WNS), given the name because of the white fungal growth observed on affected bats, it is caused by the bats contracting a fungus identified as *Geomyces destructans*. In as little as four years WNS has claimed the lives of at least a million bats and infected hibernacula in the northeast, resulting in mortality rates upwards of 95 percent. It's not clearly known, but the fungus appears to disrupt bats hibernation by causing them to repeatedly

awaken, thereby depleting essential fat reserves. Once the fat reserves have been depleted bats attempt to emerge early to forage and are met with unfavorable weather conditions that almost always leads to mortality.




## Habitat Descriptions

*Winter Habitat*: Caves or deep mines (including coal and limestone as well as other mineral recovery operations) are the typical wintering habitat for NLEB. This species has been found in the majority of hibernacula known to harbor bats in Kentucky. The northern long-eared bat utilizes different habitats during the summer and winter months. Hibernacula vary from large caves and abandoned mines with large entrances and passages to smaller features. Preferred features have relatively constant, cool temperatures (0 to 9° C), high humidity, and minimal air currents. This species typically roosts in small crevices and cracks in walls and ceilings; however, individuals have also been observed roosting in the open, although less frequently. In addition to mines, northern long-eared bats have been found hibernating in other cave-like, man-made structures.

Construction activities such as blasting, diversion of surface water away from or toward a cave or mine system, altering of airflow or temperature within a cave system, and altering cave or mine passages are all potential impacts to NLEB winter habitat. Any cumulative impacts (changes that are likely to occur in the reasonably foreseeable future) to NLEB habitat, as a result of the project, should be considered as well.

*Summer Habitat*: NLEB summer habitat includes any tree greater than or equal to 5” dbh that possesses any or all of the following characteristics; exfoliating bark, dead or dying trunk/limbs, cavities and fissures associated with lightning strikes or ice/wind damage, woodpecker holes, and heart rot. These trees can be found in various landscapes including floodplains and bottomlands, slopes and ridges, as

well as upland areas. Also man-made structures such as barns, houses and sheds are used to a smaller extent by NLEB in the summer months.

*Foraging Habitat*: Summer habitat for the northern long-eared bat consists of a variety of forested habitats used for roosting, foraging, and commuting, including forest blocks and woodlots, as well as linear features such as fencerows, riparian forests, and other wooded corridors. These forested areas may be dense or loose aggregates of trees with variable amounts of canopy closure. Suitable summer roosting habitat consists of live or dead trees and snags with a dbh of three inches or greater that exhibit any of the following characteristics: exfoliating bark, crevices, cavities, or cracks. This species is more likely to roost in crevices, cracks, and cavities than other *Myotis* species and is more opportunistic when selecting a roost tree, often utilizing shorter trees with smaller dbhs and tree stumps. Reproductive females typically prefer taller trees with larger dbhs located in more open areas. Non-reproductive females and males use trees of varying size and age, but may also roost in caves and mines during the summer. Northern long-eared bats have also been found roosting in man-made structures, including barns, sheds, and bat houses. Foraging habitat includes mature upland forests along hillsides and ridges. This species may also forage in more open areas, such as forest clearings, over open water, and along roads; however, it is less likely to forage in riparian areas. Commuting habitat is used to travel between roosting and foraging areas and typically includes forest edges and linear features, such as riparian corridors and fencerows.

The most likely impacts associated with transportation projects are disturbance and removal of forested summer habitat, disturbance of caves and cave-like openings, and alterations to foraging habitat. The loss of summer habitat could result in direct mortality if the area being cleared is inhabited by bats at the time of clearing. Foraging habitat can also be impacted through tree clearing that removes forested travel corridors that potentially connect foraging sites to roost sites or removes forested borders from streams or other water bodies. New corridor construction, widening of an existing roadway that requires clearing, bridge replacements that require tree removal, and excess fill areas that are located in wooded or partially wooded areas are all activities that could impact NLEB. Bridge and culvert construction can also affect stream foraging areas either through the loss of riparian vegetation or the production of in-stream sediment that could potentially reduce the aquatic insect production of that waterway.

## Critical Habitat

None

## Range

The range of this species includes the eastern and north-central United States and all Canadian provinces from the Atlantic Coast to the southern Yukon Territory and eastern British Columbia. In the United States, the northern long-eared bat has been found in 37 states, ranging from Maine to Montana, south to eastern Kansas, eastern Oklahoma, and Arkansas, and east to South Carolina. Known hibernacula have been documented in 29 of the 37 states within the species' range. Northern long-eared bats in the United States can be divided into four distinct groups, including eastern, Midwestern, southern, and western populations. Historically, the northern long-eared bat was found in greatest abundance in the eastern portion of its range. The species is more scattered and less common in the Midwest and southern portions of the range and is considered uncommon or rare throughout the majority of the western range.

In Kentucky, the northern long-eared bat has been recorded in 91 of the 120 counties and is considered to be present statewide. Summer occurrences have been recorded in 85 counties, including 68 counties with reproductive records (i.e. captures of juveniles or pregnant, lactating, or post-lactating females).

## Special 4(d) Rule

With a threatened status, a special rule can be issued under Section 4(d) of the Endangered Species Act. The US Fish and Wildlife Service has authorized certain species specific exemptions for the northern long-eared bat since its listing was largely based on the effects of whitenose syndrome on this species.

The decline of the northern long-eared bat species has increased the significance of locations where this species is known to have successfully roosted or hibernated. Therefore, actions occurring within 150 feet of a known northern long-eared bat maternity roost tree or within 0.25 mile of a known hibernacula must be evaluated on an individual basis and is not eligible for use of the 4(d) rule.
A listing of 7.5 minute quadrangles that contain such features is provided below (November 17, 2016), but the most current listings can be found on the USFWS website here:

https://www.fws.gov/midwest/endangered/mammals/nleb/nhisites.html

## KENTUCKY TOPOGRAPHIC QUADRANGLES CONTAINING NORTHERN LONG-EARED BAT ROOST TREES AND/OR HIBERNACULUM

U.S. Fish and Wildlife Service – Kentucky Field Office
And
Kentucky Department of Fish and Wildlife Resources
November 17, 2016

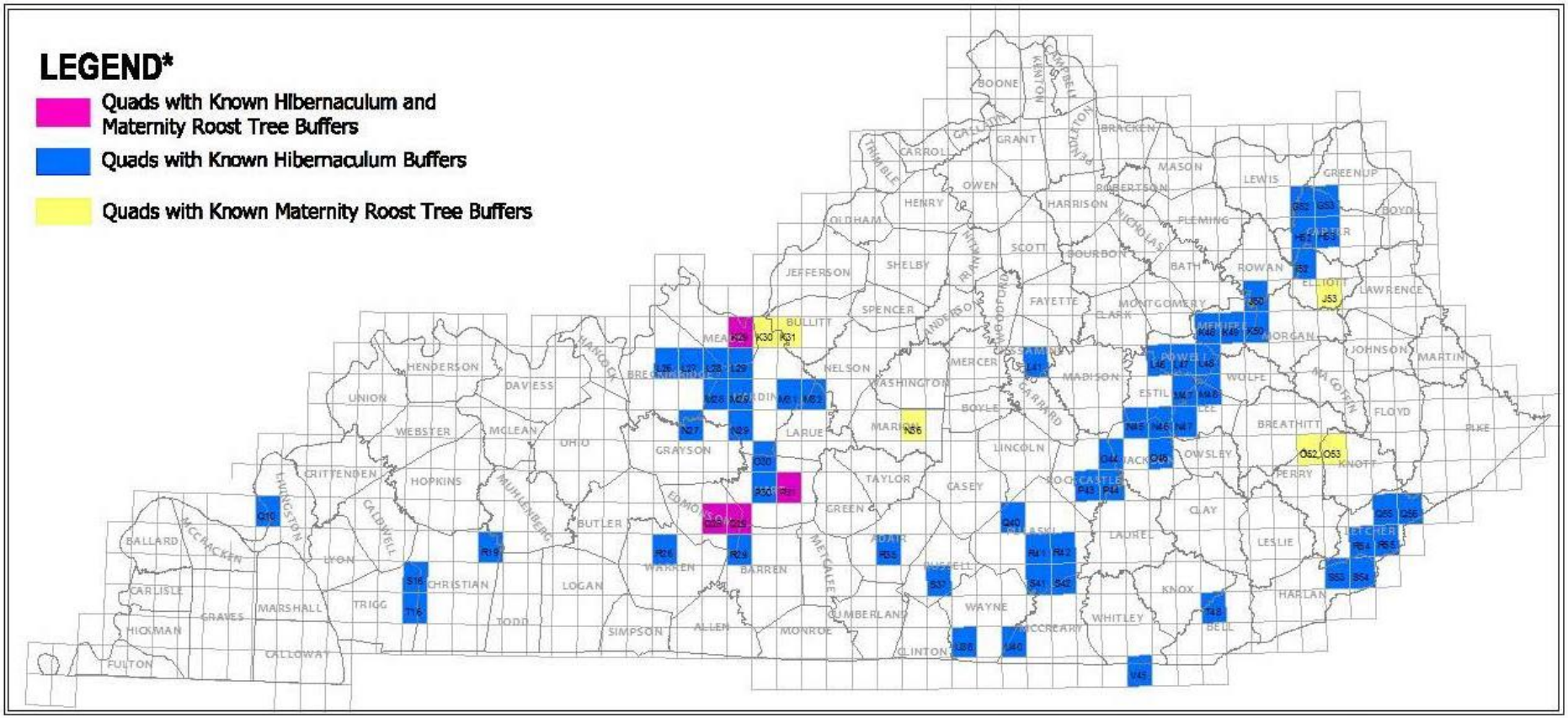
- U.S. Fish and Wildlife Service rules restrict activity around northern long-eared bat roost trees and hibernacula.
- The quadrangles (quads) listed below contain one or more northern long-eared bat known hibernaculum and/or known maternity roost trees.
- These data are current as of November 17, 2016. Updates of this information will be released by U.S. Fish and Wildlife Service as new information becomes available.

| Quad Tile | Quad Name | Counties with Known Hibernaculum and/or Roost Trees | One or more hibernacula | One or more roost trees |
|---|---|---|---|---|
| G52 | WESLEYVILLE | Carter | Yes | No |
| G53 | TYGARTS VALLEY | Carter | Yes | No |
| H52 | OLIVER HILL | Carter | Yes | No |
| H53 | GRAHN | Carter | Yes | No |
| I52 | AULT | Elliott | Yes | No |
| J50 | BANGOR | Menifee and Rowan | Yes | No |
| J53 | ISONVILLE | Elliott | No | Yes |
| K29 | ROCK HAVEN | Meade | Yes | Yes |
| K30 | FORT KNOX | Bullitt | No | Yes |
| K31 | PITTS POINT | Bullitt | No | Yes |
| K48 | FRENCHBURG | Menifee | Yes | No |
| K49 | SCRANTON | Menifee | Yes | No |
| K50 | EZEL | Menifee | Yes | No |
| L26 | HARDINSBURG | Breckinridge | Yes | No |
| L27 | GARFIELD | Breckinridge | Yes | No |
| L28 | BIG SPRING | Breckinridge and Hardin | Yes | No |
| L29 | FLAHERTY | Hardin | Yes | No |
| L41 | LITTLE HICKMAN | Jessamine | Yes | No |
| L46 | CLAY CITY | Estill and Powell | Yes | No |
| L47 | STANTON | Estill and Powell | Yes | No |
| L48 | SLADE | Powell | Yes | No |
| M28 | CONSTANTINE | Breckinridge and Hardin | Yes | No |
| M29 | HOWE VALLEY | Hardin | Yes | No |
| M31 | ELIZABETHTOWN | Hardin | Yes | No |
| M32 | NELSONVILLE | Hardin and Larue | Yes | No |
| M47 | COBHILL | Estill and Lee | Yes | No |
| M48 | ZACHARIAH | Estill, Lee, and Wolfe | Yes | No |
| N27 | MADRID | Breckinridge | Yes | No |
| N29 | SUMMIT | Grayson and Hardin | Yes | No |

| Quad Tile | Quad Name | Counties with Known Hibernaculum and/or Roost Trees | One or more hibernacula | One or more roost trees |
|---|---|---|---|---|
| N36 | LEBANON EAST | Marion | No | Yes |
| N45 | ALCORN | Estill and Jackson | Yes | No |
| N46 | LEIGHTON | Jackson | Yes | No |
| N47 | HEIDLEBERG | Lee | Yes | No |
| O30 | UPTON | Hardin, Hart, and Larue | Yes | No |
| O44 | JOHNETTA | Jackson and Rockcastle | Yes | No |
| O46 | MCKEE | Jackson | Yes | No |
| O52 | NOBLE | Breathitt, Knott, and Perry | No | Yes |
| O53 | VEST | Breathitt, Knott, and Perry | No | Yes |
| P30 | MUNFORDVILLE | Hart | Yes | No |
| P31 | CANMER | Hart | Yes | Yes |
| P43 | MOUNT VERNON | Rockcastle | Yes | No |
| P44 | LIVINGSTON | Rockcastle | Yes | No |
| Q10 | SMITHLAND | Livingston | Yes | No |
| Q28 | RHODA | Edmonson | Yes | Yes |
| Q29 | MAMMOTH CAVE | Barren, Edmonson, and Hart | Yes | Yes |
| Q40 | SCIENCE HILL | Pulaski | Yes | No |
| Q55 | MAYKING | Letcher | Yes | No |
| Q56 | JENKINS WEST | Letcher | Yes | No |
| R19 | HALEYS MILL | Christian | Yes | No |
| R26 | BOWLING GREEN NORTH | Warren | Yes | No |
| R29 | PARK CITY | Edmonson | Yes | No |
| R35 | COLUMBIA | Adair | Yes | No |
| R41 | SOMERSET | Pulaski | Yes | No |
| R42 | DYKES | Pulaski | Yes | No |
| R54 | ROXANA | Harlan and Letcher | Yes | No |
| R55 | WHITESBURG | Letcher | Yes | No |
| S16 | GRACEY | Christian | Yes | No |
| S37 | JAMESTOWN | Russell | Yes | No |
| S41 | BURNSIDE | Pulaski | Yes | No |
| S42 | HAIL | Pulaski | Yes | No |
| S53 | LOUELLEN | Harlan and Letcher | Yes | No |
| S54 | BENHAM | Harlan and Letcher | Yes | No |
| T16 | CALEDONIA | Trigg | Yes | No |
| T48 | PINEVILLE | Bell | Yes | No |
| U38 | POWERSBURG | Wayne | Yes | No |
| U40 | BELL FARM | McCreary | Yes | No |
| V45 | JELLICO EAST | Whitley | Yes | No |

## U.S. Fish & Wildlife Service

### Map of Quadrangles Containing Known Northern Long-eared Bat Hibernacula &/or Maternity Roost Trees (November 2016)




NOTE: This map is based on species occurence information and is subject to change as new data become available. Please contact our office at 502/695-0468 to ensure you are working with the most current version.
*For an explanation of terms, please refer to the final 4(d) rule for the northern long-eared bat.

The USFWS makes no warranty for use of this map and cannot be held liable for actions or decisions based on map content. This map was produced as an appendix to the Conservation Strategy for Forest-Dwelling Bats in the Commonwealth of Kentucky and should only be used in the context of this Strategy.

## Habitat Assessment Methods

KYTC personnel who have received training on the implementation of the HAM may conduct project reviews to determine if potential NLEB summer and/or winter habitat is present and would be affected by a specific project.

*Office Assessment:*
Review geologic quads for indications of potential winter habitat such as karst/cave features, presence of karst bearing strata (Ordovician and Mississippian age limestone), quarry sites, mine adits, and elevations of coal seams within 1 km of the project's disturbed limits. Review should also include accessing Energy and Environment Cabinet (EEC) Division of Mines' GIS layers for the presence of active and abandoned deep mines near the project area. Begin with best available remote-sensing data including; aerial photography, topographic quadrangles, right-of-way strip maps, plan sheets indicating vegetation, etc.

*Field Assessment:*
On-site inspections should include walking the project area (any areas that would be directly or indirectly impacted by the project) to locate potential winter and/or summer roosting habitat. Known openings identified during office assessment as well as identifying the presence of unknown openings (wildcat mines, collapsed adits, open-throat sinkholes, etc.) should be documented.

## Decision Key

1) Does the project require the removal of **any tree(s)** greater than or equal to 5" diameter at breast height regardless of the structure and characteristics of the tree(s) **OR** occur in one of the **quadrangles known for northern long-eared bat** maternity roost sites or hibernacula?

    a. Yes: Contact SME
    b. No: Go to Step 2

2) Did survey of the project area, USGS quad, or any other resource (document all resources consulted or agency coordination undertaken) identify any of the following within 1 km of the project area?

    - Caves
    - Mine adits
    - Open throated sinkholes
    - Other karst features

    a. Yes: Contact SME
    b. No: Prepare a No Effect finding

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# Virginia Big-Eared Bat (*Corynorhinus townsendii virginianus)*

## Species Description

Virginia big-eared bat was listed as **endangered** on November 30, 1979.

The Virginia big-eared bat is a medium-sized bat with pale to dark brown fur on the back to a light brown on the belly. They generally weigh between 7-12 grams, have large ears, and have short toe hairs.

Virginia big-eared bats are described as a year-round, cave-dwelling species. During the winter, when their food source (flying insects, primarily moths) is unavailable, Virginia big-eared bats hibernate in cool, well ventilated, portions of caves (known as hibernacula). The hibernacula may contain only a few or several thousand individuals, either solitary or in small clusters. Upon emerging in the spring (late March or early April) reproductive females move to warmer sections of the cave, or disperse to different caves, forming maternity colonies where they give birth to a single young in June. The maternity sites may be large limestone caves or small sandstone caves but they must be caves with high domed ceilings that trap warm air. Males occur singly or in small groups near the maternity sites. Non-reproductive Virginia big-eared bats use a wide variety of habitats during the summer in addition to caves such as mines, rock-shelters and large fissures in cliffs. In September, they begin to congregate at the hibernacula where they mate and eventually enter hibernation for the winter.

## Habitat Description

The Virginia big-eared bat utilize caves or cave-like structures (mines), rock shelters, and large cracks in sandstone cliffs year round, moving seasonally to different portions of these structures, or different locations, to meet specific temperature requirements. Winter hibernacula are located in larger limestone caves while summer maternity caves may be either small sandstone caves or limestone caves. Most of the habitat associated with this species is located in a highly dissected, high relief landscape. Cave entrances may be at or near ground level along steep sided stream valleys, or in the case of many of the smaller sandstone caves, halfway up a cliff face. Large cracks in sandstone cliffs are also used as daytime roosts by foraging bats but not as maternity sites.

These caves or cave-like structures are typically located in regions dominated by oak-hickory or beech-maple-hemlock forests. Virginia big-eared bats forage over fields, streams, forest edges, mountain slopes, cliff faces, and in clearings, sometimes using alternate night roosts in rock shelters during breaks in foraging.

Potential direct impacts associated with transportation projects may include disturbance of winter or summer caves or cave-like habitats. This could occur through the dumping of fill, blasting, excavation, or the diversion of water away from or toward a cave system. Any of these activities could affect cave access, alter the airflow or temperature regimes within the cave, or physically alter cave passages.

Secondary impacts as a result of construction would include: highway construction runoff into a cave system, increased access by humans or natural predators, and increased roof-fall via highway activities (vibration). Any cumulative impacts (changes that are likely to occur in the reasonably foreseeable future) to Virginia big-eared bat habitat, as a result of the project, should be considered as well.

Projects located above or below cave or cave-like habitat (particularly cliffline rock shelters and crevices) can reduce the suitability of these structures as roost sites by removing vegetation and

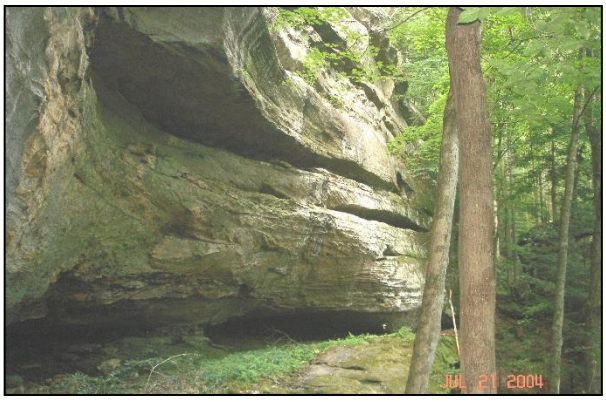
altering the amount of sun exposure, wind exposure, or noise exposure (i.e. highway noise) they receive. New corridor construction, widening that requires clearing, borrow or fill areas that are located in wooded or partially wooded areas, stream relocations, and drainage changes are all activities that could impact Virginia big-eared bat roost and foraging habitat.


In areas of limestone, cliff-lines should be searched for cave openings that do not always appear on topographic maps.


Some cave openings may be hidden from view by vegetation or debris.

Abandoned mines and quarries provide habitat for Virginia big-eared bats. Some wildcat mines do not appear on topographic maps and mine records. Field surveys should be conducted to examine for inconspicuous mine openings – usually located along old roads used to remove the minerals.

Some cave openings are level with the ground.



Cliff-lines can have layers of rock that have eroded horizontally creating caves, rock shelters, and crevices.

Rock shelters form because a rock stratum such as sandstone that's resistant to erosion and weathering has a softer stratum underneath, which is eroded horizontally creating an overhanging rock ledge ceiling.

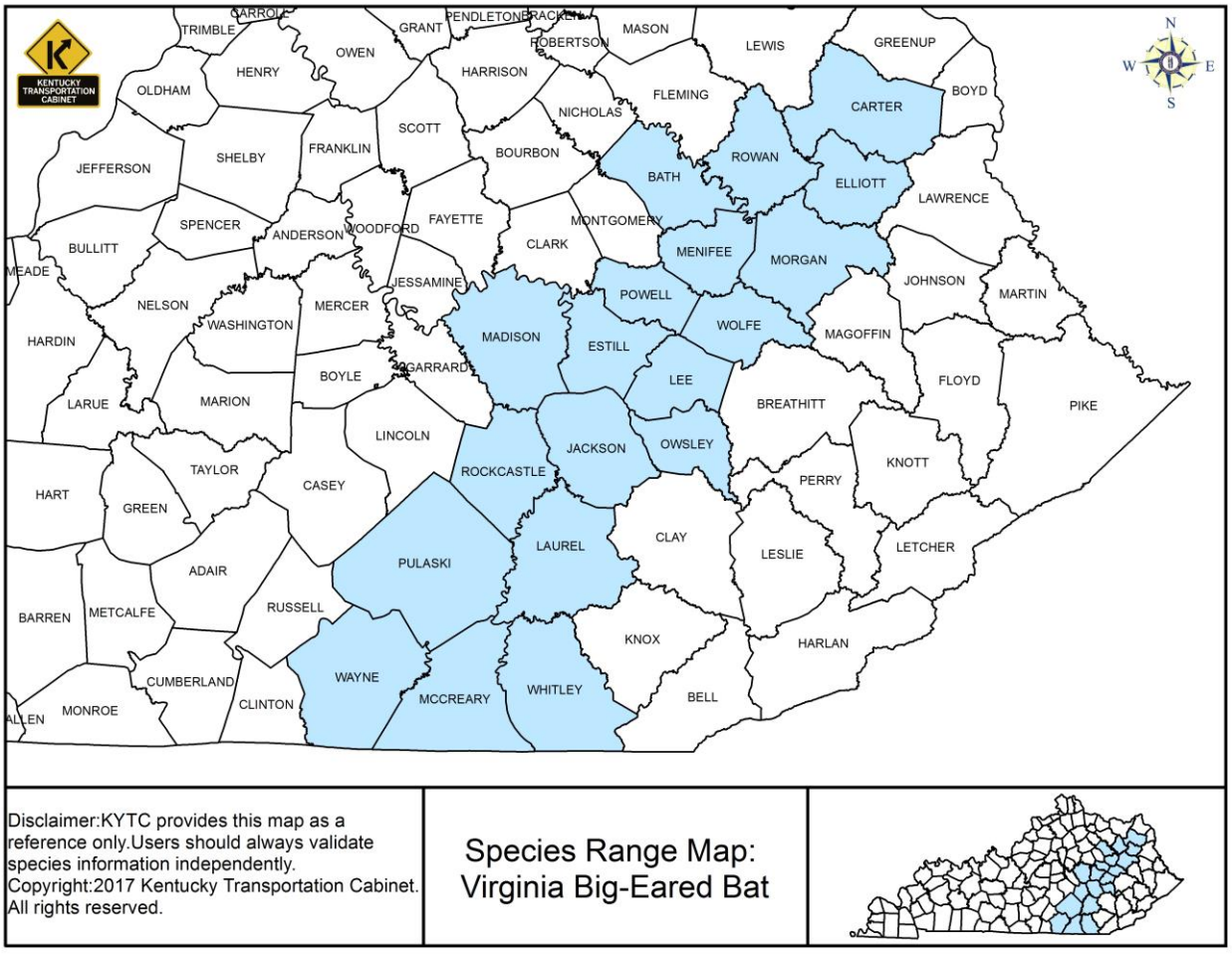
Cliff-lines, sometimes called bluff-lines, are exposed rock strata that have a prominent and almost vertical front.

## Critical Habitat

None

## Range

The range of the Virginia big-eared bat is the Appalachian Mountains of Virginia, West Virginia, North Carolina, and eastern Kentucky. The Kentucky range is a nineteen county strip that lies along the dissected edge of the Western Allegheny Plateau (Bath, Carter, Elliott, Estill, Jackson, Laurel, Lee, Powell, Madison, McCreary, Menifee, Morgan, Owsley, Pulaski, Rockcastle, Rowan, Wayne, Whitley, and Wolfe Counties).



## Habitat Assessment Methods

*Office Assessment:*
Review geologic and topographic quad maps for caves or the presence of cave bearing strata exposed in deeply dissected stream valleys (Ordovician and Mississippian age limestone), underground quarry sites, mine adits, and cliff-lines (usually sandstone). Reference mine layer on ArcGIS to identify the location of abandoned deep mines or limestone mines if you have reason to believe mining may have occurred in the project area. Coal mining in the range of the Virginia big-eared bat is uncommon. Current and former landowners are also a good source of information, as well as local spelunking groups.

*Field Assessment:*
Based on the office review, walk those areas within 1 km of the project disturbed limits that may contain known openings and confirm their presence or absence. Verify the presence of cliff-lines which may have cave openings, and limestone or sandstone rock outcrops on mountain sides that may have rock shelters or deep cracks.

## Decision Key

1) Do any of the following occur within or within 1 km of the project area:
   - Deeply dissected stream valleys with limestone strata
   - Areas of inactive underground mining (coal, limestone)
   - Karst features
   - Cliff-lines
   - Railroad tunnels (abandoned)
   - Rock shelters

   a. Yes: Contact SME
   b. No: Prepare a No Effect finding

## Literature Cited

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# Basic Introduction to Freshwater Mussels

*Photo Credit: https://www.toledoblade.com/StevePollick/2006/05/16/Freshwater-mussels-sought-by-poachers.html*

## Conservation and History

North America holds the greatest amount of freshwater mollusk biodiversity in the world, particularly in the southeastern region. There are more species of freshwater mussels in the Southeast than anywhere else on the planet. However, since the settlement of European explorers, freshwater mussel numbers have drastically declined. Practices such as stream channelization, dredging, wetland drainage, landscape pollution, farming, mining, industrialization, silvicultural practices, dam building, and other practices have altered the waterways. Such actions have aided in the reduction and ultimate destruction of many mussel populations.

Freshwater mussels are the most endangered group of organisms in North America. Nearly 300 mussel species have been recorded to occur in the United States. Of these, 104 species have been considered historically present in Kentucky; however, some species populations have been

reduced over time. Currently, 20 mussel species are considered extinct or extirpated within Kentucky and another 30 are listed as federally threatened, endangered, or are candidate for listing under the Endangered Species Act.

Habitat protection and the restocking of streams and rivers are key factors to long-term, successful mussel conservation. Several species are extremely rare and inhabit only small stretches of specific rivers. Through maintenance and improvement of the integrity of Kentucky's waterways, quality mussel habitat that may promote mussel survival into the future can be preserved. Mussel habitat varies by species and by watershed; however, all mussels must have suitable habitat for burrowing, anchoring, filtration/feeding, and breeding. Adequate substrate and water quality must be present depending on the certain species needs, along with presence of appropriate host species for mussel reproduction. Conservation measures are essential for the protection of these species, including minimization and mitigation measures performed by the Transportation Cabinet. The long-term goal of conservation is to establish reproductive and genetically viable populations so that these species ultimately may be sufficiently established to warrant removal from federal protection under the Endangered Species Act.

## Biology and Life History

In freshwater mussels, individual specimens are gonochoristic, (i.e. – individuals are either male or female with only rare hermaphroditic individuals). Species in the subfamily *Lampsilinae* are the only mussels to exhibit distinct sexual dimorphism (i.e. – there are obvious differences between the male and female of the species such as morphology, size, and ornamentation). Males release sperm into the water, which enters the female via the incurrent siphon. The eggs are then fertilized internally. The fertilized eggs develop into an intermediate larval stage termed glochidia (singular = glochidium). The glochidia are stored in the female's gills, which function as a brood chamber, as well as a means for obtaining oxygen. Some species breed in the fall and hold onto their glochidia internally until the following spring. These are long-term breeders (bradytictic). Other species breed in the spring, and release their glochidia later that year, usually at the end of summer. These are short-term breeders (tachytictic).

In the spring or summer, the glochidia are expelled into the water in order to begin the parasitic phase of their life cycle. Some species possess a lure, which attract potential host. The glochidia attach to an appropriate host, usually a fish, and form a cyst. Depending on the species of mussel, the glochidia can either be internal parasites on the gills, or external on the fins. Some mussel species are host specific, while others can use a wide variety of species to rear their glochidia. The glochidia grow on the host for a period ranging from 1 to 25 weeks, depending on several factors including mussel species, water temperature, and efficiency of nutrient transfer from the host. They eventually drop off and begin their life in the stream's substrate as infant, fully-formed mussels (Figure 1 - Cicerello and Schuster 2003).

Freshwater mussels continuously pump water through their bodies. Water enters via the incurrent or branchial siphon and exists through the excurrent or anal siphon. During this process, the mussel filters food from the water. This food consists of diatoms, detritus, plankton, and other organic sources of microscopic plants and animals.

Freshwater mussels are an ecologically important organism for Kentucky's creeks and rivers. They filter the water, provide a food source for other animals, and are biological indicators of water quality. They provide an important source of food for other animals such as muskrats, minks, otters, fish, and birds. Mussels are considered to be long-lived species with most species tending to live more than 10 years. Some mussel species even live longer than 100 years, although longevity is still unknown for various species.

## Field Identification

Habitat preferences of mussels can vary considerably by species. Some species are restricted to certain habitat types (e.g. – small creeks), while others can be found in almost any permanent body of water. Knowing characteristics of water features preferred by some mussels is only the beginning. Considerations also include variation in substrate composition and available microhabitat positions within the water body. However, like most things in nature, there are always exceptions. Even a big river mussel species can be found in smaller creeks (e.g. purple catspaw pearlymussel – *Epioblasma obliquata*). These instances make overall

dismissal of mussel species from some bodies of water difficult. In some cases, not enough is known about the life history of a particular species and it could possibly range in a greater variety of habitat types than is currently expected; or historic surveys were not exhaustive efforts for a difficult to locate mussel, and its distribution may currently be under estimated (e.g. – rayed bean – *Villosa fabilis*). Unfortunately, mussel habitat evaluation is not always a simple or straightforward process.

Given the vast number of mussel species in southeastern North America and the great degree of morphological variation that mussel species exhibit throughout their habitat types, identification of freshwater mussel species may prove difficult, even for experts. Even within species, shell variation is great and can be quite an obstacle to overcome for identification. The body of a freshwater mussel consists of the "soft parts" and the shell. The soft parts of a mussel refer to its foot, gills, mantle and other body system structures. These parts decompose and remove from the hard shell shortly after death; therefore, the majority of mussel identification relies solely on the shell. Even with the soft parts intact, this does not lend to easier identification in most cases, and identification still relies largely on shell characteristics. This can be problematic because the shells of some common species can appear nearly identical to more rare species. Species can have typical morphological features to aid in their identification (Figure 2 – Cicerello and Schuster 2003), but biologists may have to rely more on experience when identifying some specimens.

## Stream/ River Descriptions

Throughout the HAM, descriptors of water bodies such as "small streams" or "large rivers" are used. Unfortunately these ambiguous terms can only be clarified to a certain degree. What looks like a medium sized river to some, may appear to be a large stream to others, and neither may be wrong. Stream order (Strahler classification) can be a means of establishing water bodies' size, but again is not 100% clear cut. A 3rd order stream in eastern Kentucky would likely have a different volume of water than a 3rd order in western Kentucky. Stream order is based on topography and how the water drains from the land. Typically, small rivers are considered to be approximately 3rd to 5th order, but a set definition is not axiomatic.

The following photographs provide visualizations of the multiple sizes of water bodies that some might consider belonging to a certain size class (photos courtesy of KYTC and Third Rock Consultants, Ltd.). These photos are included merely to depict the variety of water bodies and the terms to which they may belong, and are not all-encompassing or meant for use as a pass/fail assessment. Unfortunately, things in nature are not always clear or straightforward, so we must make the best, most educated decisions and actions that we can.

Small/Medium Streams

Medium/Large Streams

Large Streams/Small Rivers

Small/Medium Rivers

Medium/Large Rivers

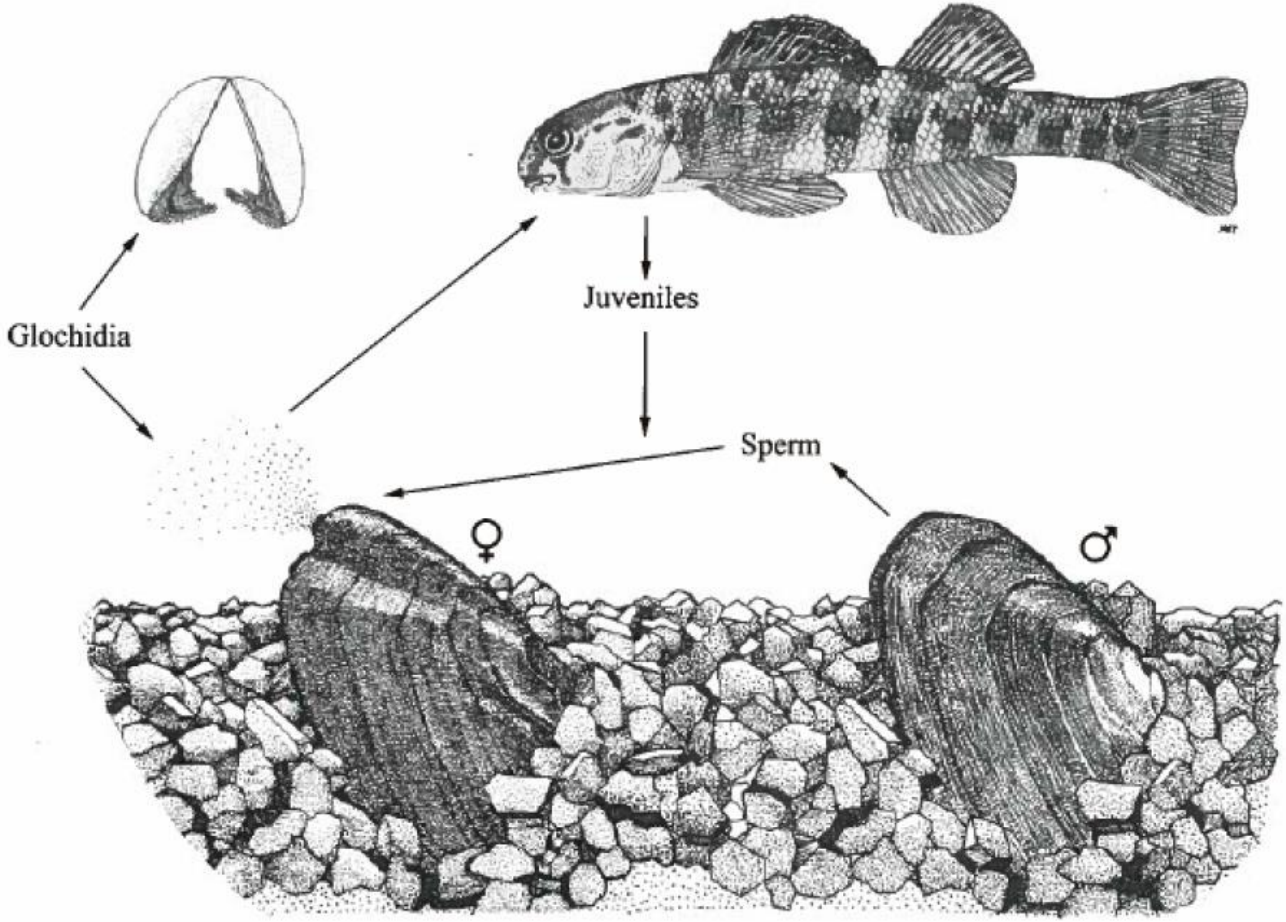



Figure 1. Generalized life cycle of freshwater mussels, as exemplified by the littlewing pearlymussel (*Pegias fabula*) and a host fish, the emerald darter (*Etheostoma baileyi*). Following the fertilization of eggs within the female, parasitic larval mussels called glochidia develop. The glochidia are released into the water, attach to a host fish, and encyst. The glochidia transform into juvenile mussels after a few weeks, drop from the fish, and fall to the bottom.

Cicerello, R.R. and G.A. Schuster. 2003. A guide to the freshwater mussels of Kentucky. Kentucky State Nature Preserves Commission Scientific and Technical Series, 7:1-62.

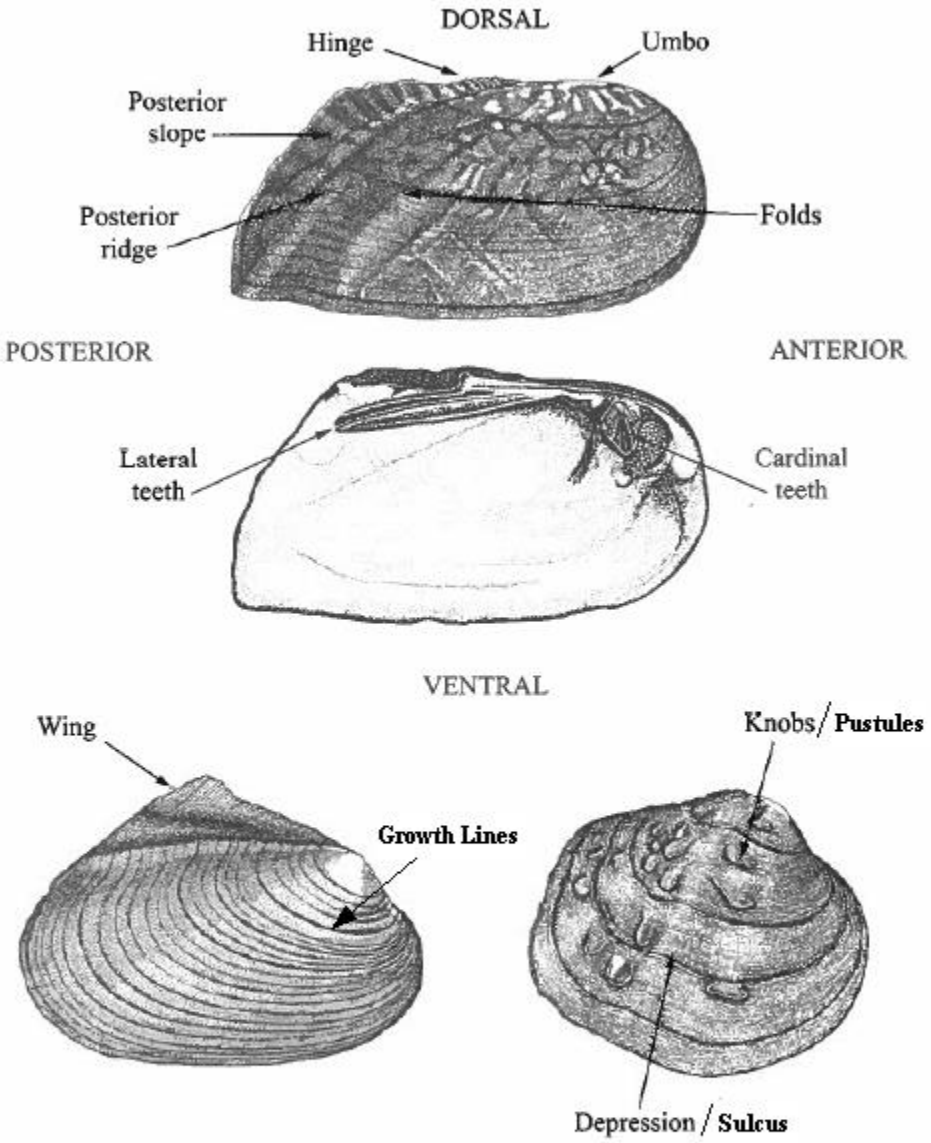



Figure 2. Major features of freshwater mussel shells, as exemplified by the bankclimber (*Plectomerus dombeyanus*), pink heelsplitter (*Potamilus alatus*), and mapleleaf (*Quadrula quadrula*). The drawings show the exterior of the right valve (top) and interior of the left valve (middle) of the bankclimber, and the exterior of the right valves of the pink heelsplitter (bottom left) and mapleleaf (bottom right).

Cicerello, R.R. and G.A. Schuster. 2003. A guide to the freshwater mussels of Kentucky. Kentucky State Nature Preserves Commission Scientific and Technical Series, 7:1-62.

# Glossary

**Anterior** – the shell end nearest the umbo; the front end.

**Cardinal Teeth** – teeth-like structures inside the shell at the hinge at the anterior dorsal margin.

**Compressed** – the shell is flattened from side to side.

**Dorsal** – the top of the shell where the hinge is located.

**Endemic** – restricted to a particular locality (region, drainage, or political boundary).

**Growth Lines** – darkened lines on the surface of the shell indicating periods of rest during growth.

**Hinge** – the elastic dorsal margin that joins the shell.

**Inflated** – the shell is swollen or expanded from side to side.

**Lateral Teeth** – the elongate teeth inside the shell along the hinged margin.

**Nacre** – the variously colored interior layer of the shell.

**Periostracum** – the outside covering of the shell.

**Posterior** – the end of the shell farthest from the umbo; the back end.

**Posterior ridge** – a ridge extending from the umbo to the posterior-ventral margin.

**Pustules/ knobs** – bumps on the shell's exterior.

**Ray** – solid or broken colored lines on the shell's exterior.

**Serrated** – notched or jagged.

**Sulcus** – a shallow depression on the outside surface of the shell.

**Umbo** – the raised or inflated part of the anterior-dorsal margin of the shell; also called the beak.

**Ventral** – the bottom edge of the shell.

**Wing** – flattened fin-like shell extension located dorsally and usually posterior but sometimes anterior of the umbo.

# Clubshell Mussel (*Pleurobema clava*)

## Species Description

The clubshell mussel (*Pleurobema clava*) was listed as an **endangered** species on January 22, 1993.

Photo Credit:
http://wwx.inhs.illinois.edu/collections/mollusk/publications/guide/index/56/

The shell is an elongate triangle, compressed, and thick. Umbo extends above hinge line and projects anteriorly. Posterior ridge and slope rounded, occasionally bordered ventrally by a shallow depression. Shell smooth, brown or yellowish-brown, with broken green rays nearer the umbo. Cardinal teeth are large and serrated; lateral teeth are thick and straight or curved. Nacre white, iridescent posterior. Length 2-3 inches.

## Habitat Description

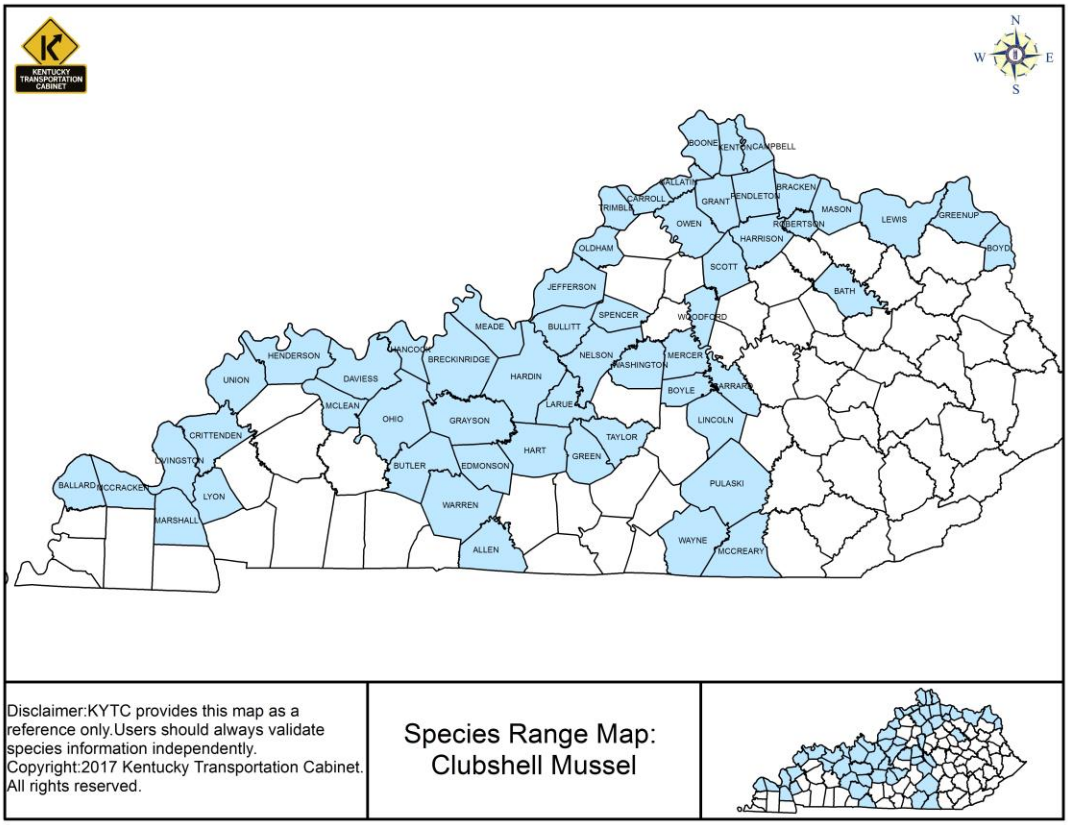
The clubshell occurs in **small streams to large rivers** in clean, coarse sand and cobble mixes with a current. It is most common just downstream of riffles and islands. It may live several inches beneath the surface. In general, it cannot tolerate mud or slack-water conditions and is very susceptible to siltation.

## Critical Habitat

None

## Range

The clubshell inhabits watersheds in Kentucky which include the Ohio River, Kentucky River, Salt River, Licking River, Tennessee River, Cumberland River, and Rockcastle River. A non-essential, experimental population has also been established in Alabama.




## Decision Key

1) Does the project include any direct or indirect effects to **perennial streams or their nearby tributaries?** (e.g. – remove riparian vegetation, alter stream banks, change water levels/flow, dredge, construct/remove bridge piers, etc.)

    a. Yes: Go to #2
    b. No: Prepare NE finding

2) Does the stream have obvious layers of mud or silt covering the top of the stream's substrate? If you cannot discern the stream's substrate, contact your SME.

    a. Yes: Prepare NE finding
    b. No: Contact SME

# Cracking Pearlymussel (*Hemistena lata*)

## Species Description

The cracking pearlymussel was listed as an **endangered** species on September 28, 1989.

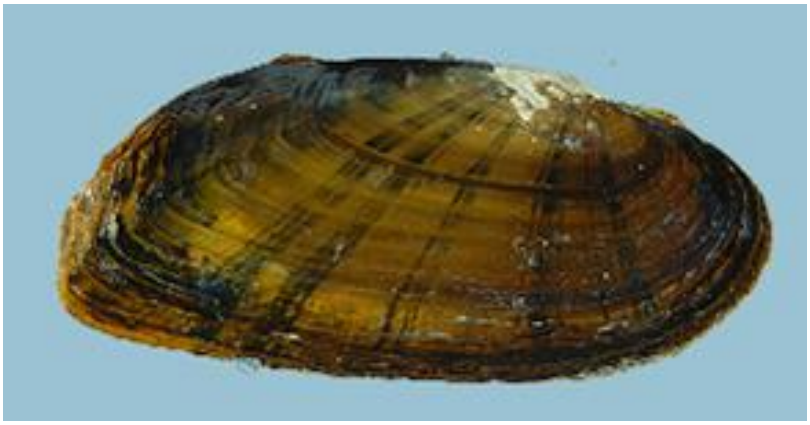


Photo Credit:
http://wwx.inhs.illinois.edu/collections/mollusk/publications/guide/index/70/

The shell is long, lanceolate, and not inflated. Dorsal and ventral margins are relatively straight. Anterior margin rounded, and posterior margin pointed ventrally. The shell's outer surface is brownish green to brown and often has broken dark green rays. Umbo is very wide and low, very near even with hinge line. The nacre color is white to pale-bluish to purple. Cardinal teeth are small and blade like; lateral teeth a thickening of the hinge line. Length 3-4 inches.

## Habitat Description

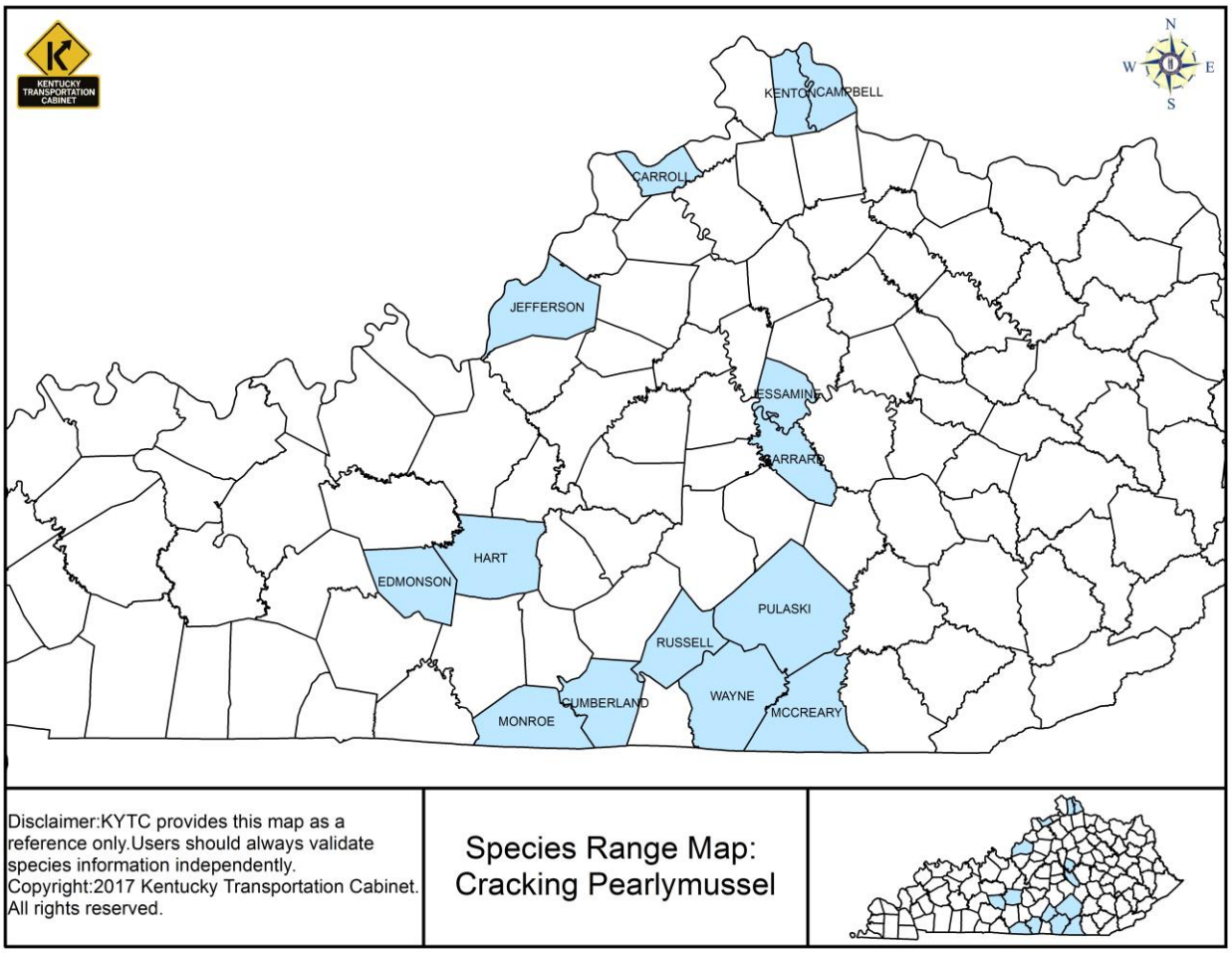
The species inhabits **medium to large sized rivers** in sandy mud, cobble, and gravel mixtures. It is often found deeply buried in substrate, and can bury quickly after being disturbed. This species has been found in depths of less than two feet of water, often on the periphery of larger rivers.

## Critical Habitat

None

## Range

The cracking pearlymussel inhabits watersheds in Kentucky which include the Ohio, Green, Cumberland, and Kentucky River systems. It is considered extirpated from most of its range. A non-essential experimental population has been established in the Tennessee River below Wilson Dam in Alabama, and in the Lower French Broad River in Tennessee.




## Decision Key

1) Does the project include any direct or indirect effects to any **medium to large rivers** or their nearby tributaries? (e.g. – remove riparian vegetation, alter stream banks, change water levels/flow, dredge, construct/remove bridge piers, etc.)

    a. Yes: Contact SME
    b. No: Prepare NE finding

# Cumberland Bean (*Venustaconcha troostensis*)

AKA: *Villosa trabalis*


Photo Credit: http://www.arkive.org/cumberland-bean-pearly-mussel/villosa-trabalis/

## Species Description

The Cumberland bean was listed as federally **endangered** in 1976.

Shells of the Cumberland bean are solid and elongate with inflated, inequilateral, and irregularly oval valves. The ventral margin is evenly curved. Female shells reach a slightly larger size than males. The periostracum is olive green with numerous faint wavy green rays, whereas the nacre is a bluish white or white, with a bluish iridescence posterior. Umbos even with or extend above hinge line. Cardinal teeth and large and serrated; lateral teeth thick and slightly curved. Length 2-2.5 inches.

## Habitat Description

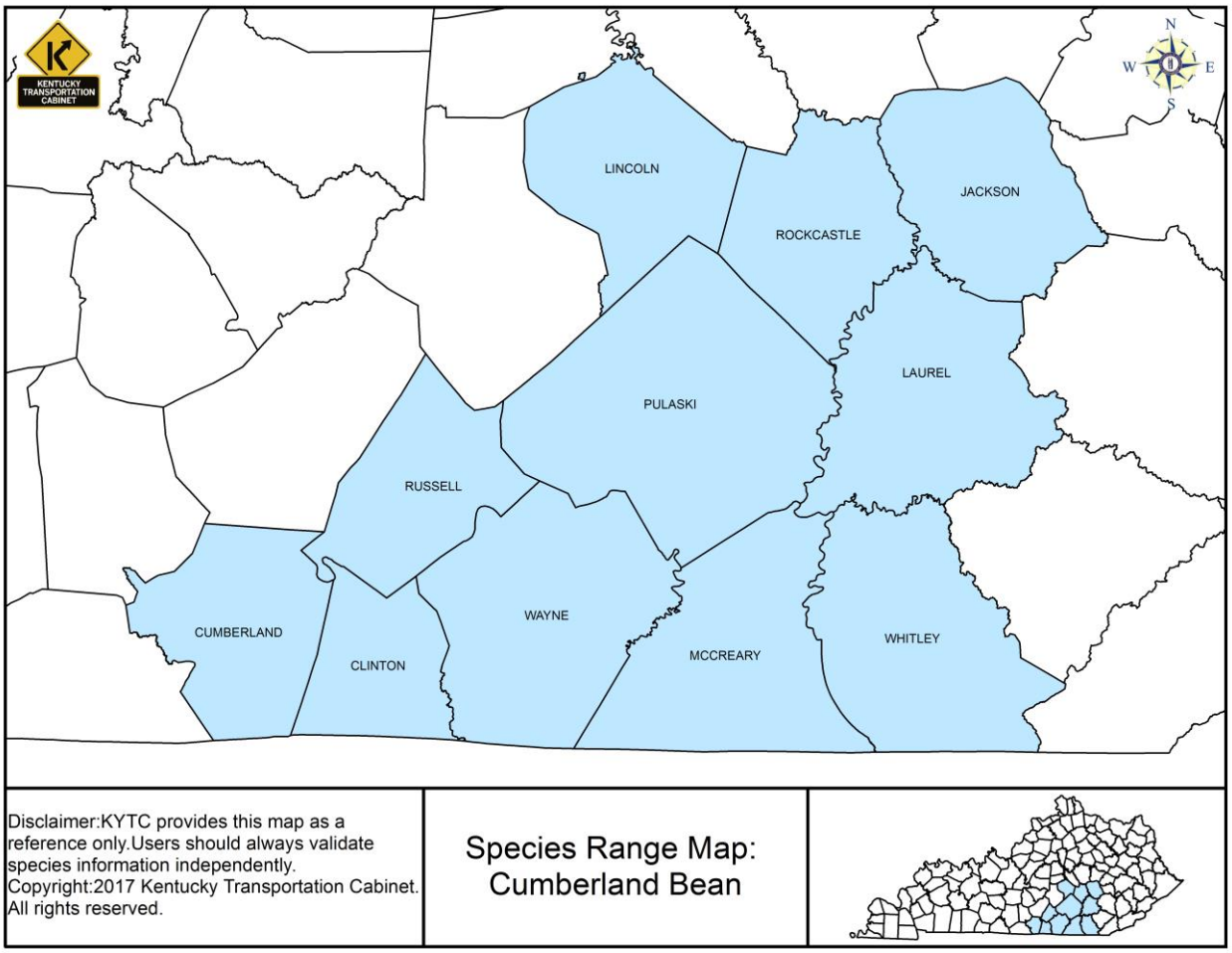
The Cumberland bean occurs in **small streams to medium sized rivers**. They can be found in substrates of sand, gravel, and cobble in moderate to swift currents and depths less than 3 feet. They are often associated with vegetated islands in stream channels (e.g. – *Justicia spp*. and *Valisneria spp*.). They can be found buried, or on top of, the consolidated substrate at these vegetated islands.

## Critical Habitat

None

## Range

Historically the Cumberland bean was reported in several locations in both the Cumberland and Tennessee River systems. The Cumberland bean is still associated with the upper Cumberland River system and Rockcastle River in Kentucky. A non-essential experimental population has been established in the Tennessee River below Wilson Dam in Alabama, and in the Lower French Broad River in Tennessee.




## Decision Key

1) Does the project include any direct or indirect effects to **perennial streams or their nearby tributaries**? (e.g. – remove riparian vegetation, alter stream banks, change water levels/flow, dredge, construct/remove bridge piers, etc.)

    a. Yes: Contact SME
    b. No: Prepare NE finding

# Cumberland Elktoe (*Alasmidonta atropurpurea*)

## Species Description

Photo Credit: http://www.flickr.com/photos/ttravisbrownphotos/8696376556/

The Cumberland elktoe was listed as an **endangered** species on January 10, 1997.

The Cumberland elktoe has a thin, but not fragile, shell. The periostracum is smooth, somewhat shiny, and covered with greenish rays. Young specimens have a yellowish brown periostracum, while specimens of adults are generally much darker. The nacre is shiny, with the color being white, bluish white, or sometimes peach or salmon. Cardinal teeth are variable and can range from small, knob like and smooth to a well developed, single, elongated, thickened tooth in the right valve, which is more pronounced than the usually two less distinct teeth in the left valve; lateral teeth are hardly more than the thickening of the hinge line. Length 3-4 inches.

## Habitat Description

The Cumberland elktoe inhabits **small streams to medium-sized rivers** and may extend into headwater streams where it is often the only mussel present. It has been reported that the species appears to be most abundant in flats, which can be described as shallow pool areas lacking the bottom contour development of typical pools, with sand and scattered cobble/boulder material, relatively shallow depths, and slow (almost imperceptible) currents. This species is also reported from swifter currents and in areas with mud, sand, and gravel substrates. It can even be found living in cracks of bedrock ledges.

The Cumberland elktoe has shown some affinity for soft waters, or at least a tolerance of varying water hardness levels. This may also be another reason that sometimes the Cumberland elktoe is the only mussel found in certain stretches of water, particularly above the Cumberland Falls.

## Critical Habitat

Yes (*see additional maps and detailed descriptions provided after the decision key*)

Critical habitat for the Cumberland Elktoe was designated on August 31, 2004.

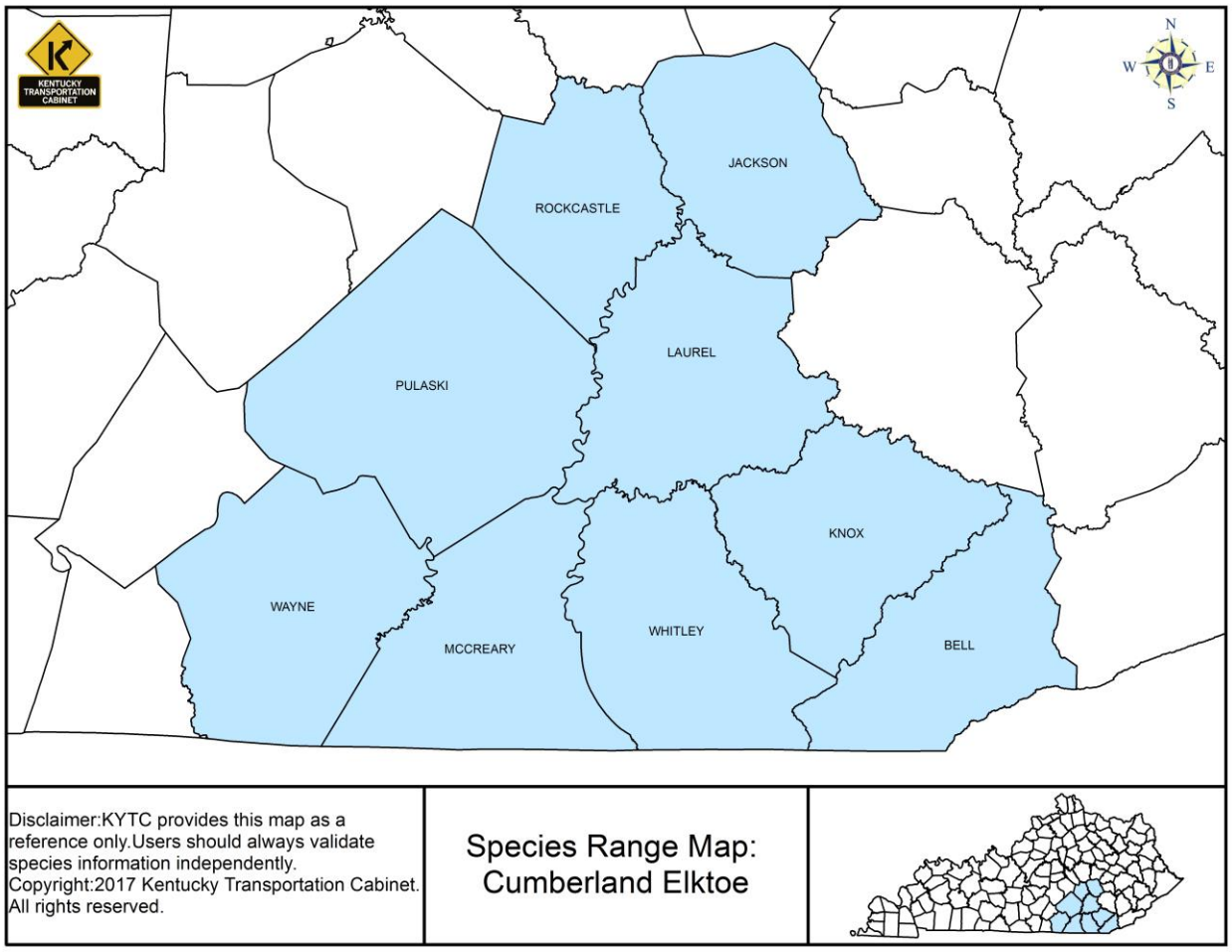
Primary constituent elements of critical habitat for this species include:

1. Permanent, flowing stream reaches with a flow regime (*i.e*, the magnitude, frequency, duration, and seasonality of discharge over time) necessary for normal behavior, growth, and survival of all life stages of the five mussels and their host fish.
2. Geomorphically stable stream and river channels and banks (structurally stable stream cross section).
3. Stable substrates, consisting of mud, sand, gravel, and/or cobble/ boulder, with low amounts of fine sediments or attached filamentous algae.
4. Water quality (including temperature, turbidity, oxygen content, and other characteristics) necessary for the normal behavior, growth, and survival of all life stages of the mussels and their host fish.
5. Fish hosts with adequate living, foraging, and spawning areas.

| Species, Stream (unit), and State | Currently Occupied River Miles | Currently Unoccupied River Miles |
|---|---|---|
| **Cumberland Elktoe** | | ..... |
| Rock Creek (Unit 8), KY | 11 | ..... |
| Big South Fork (Unit 9), TN, KY | 27 | ..... |
| North Fork White Oak Creek (Unit 9), TN | 7 | ..... |
| New River (Unit 9), TN | 9 | ..... |
| Clear Fork (Unit 9), TN | 25 | ..... |
| White Oak Creek (Unit 9), TN | 6 | ..... |
| Bone Camp Creek (Unit 9), TN | 4 | ..... |
| Crooked Creek (Unit 9), TN | 9 | ..... |
| North Prong Clear Fork (Unit 9), TN | 9 | ..... |
| Sinking Creek (Unit 11), KY | 8 | ..... |
| Marsh Creek (Unit 12), KY | 15 | ..... |
| Laurel Fork (Unit 13), TN, KY | 5 | ..... |

## Range

The Cumberland elktoe is limited in distribution to the upper Cumberland River system in southeast Kentucky and north-central Tennessee, occupying streams both above and below Cumberland Falls.



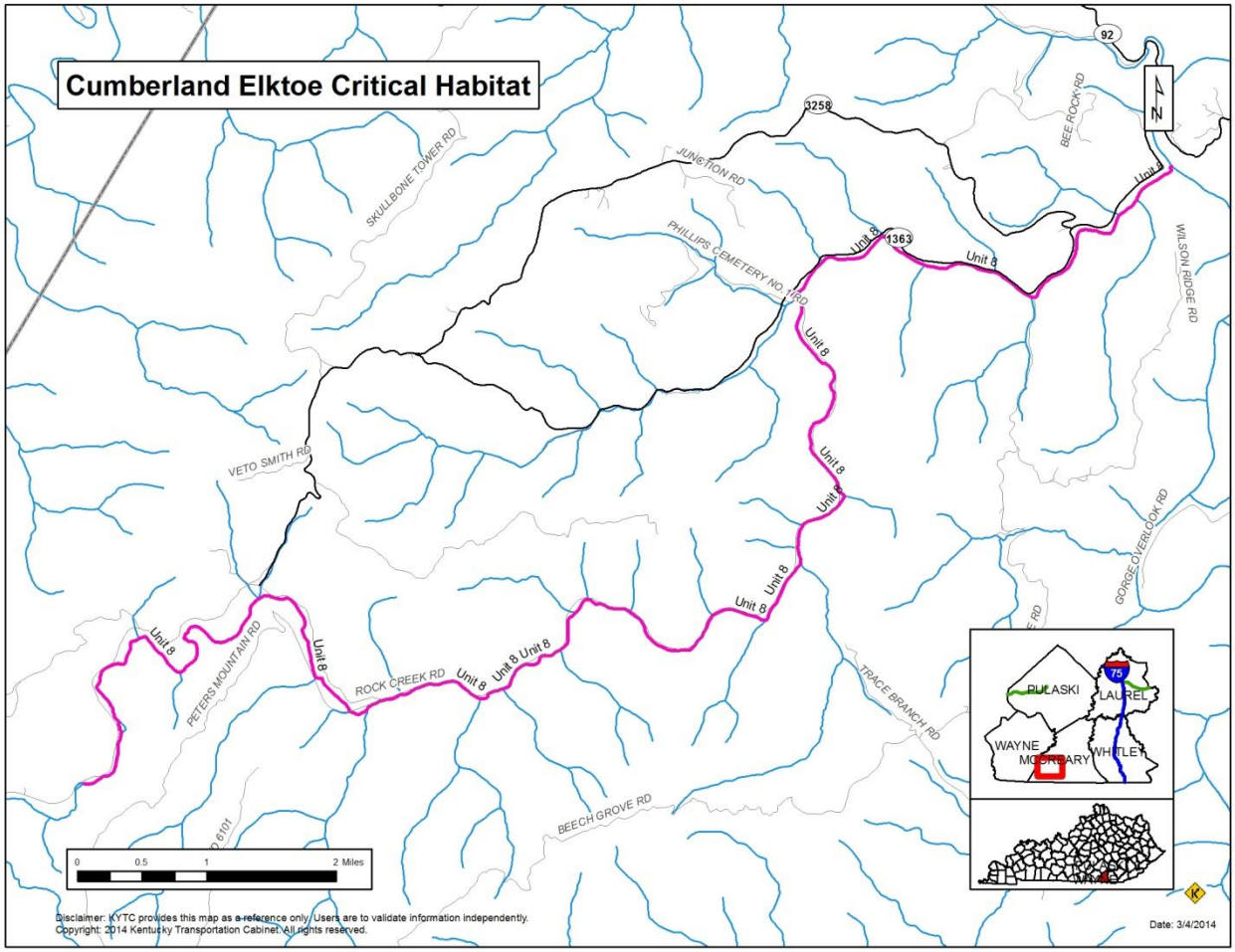

## Decision Key

1) Does the project include any direct or indirect effects to **perennial streams or their nearby tributaries**? (e.g. – remove riparian vegetation, alter stream banks, change water levels/flow, dredge, construct/remove bridge piers, etc.)

    a. Yes: Contact SME
    b. No: Prepare NE finding

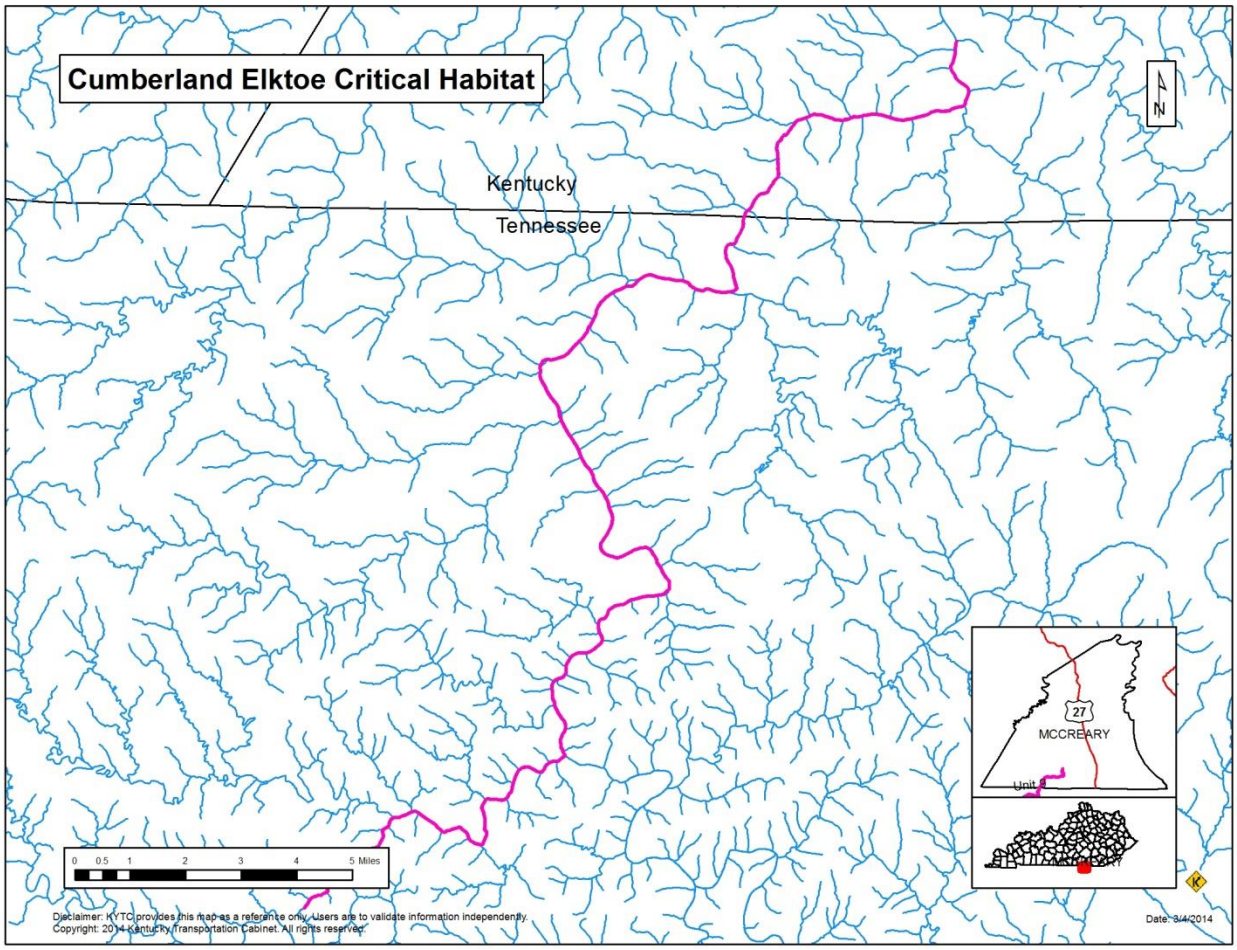
***Unit 8. Rock Creek, McCreary County, Kentucky***

Unit 8 includes 17.4 rkm (11.0 rmi) of the main stem of Rock Creek and begins at the Rock Creek/White Oak Creek confluence and extends upstream to the low water crossing at rkm 25.6 (rmi 15.9) approximately 2.6 km (1.6 mi) southwest of Bell Farm in McCreary County, Kentucky.



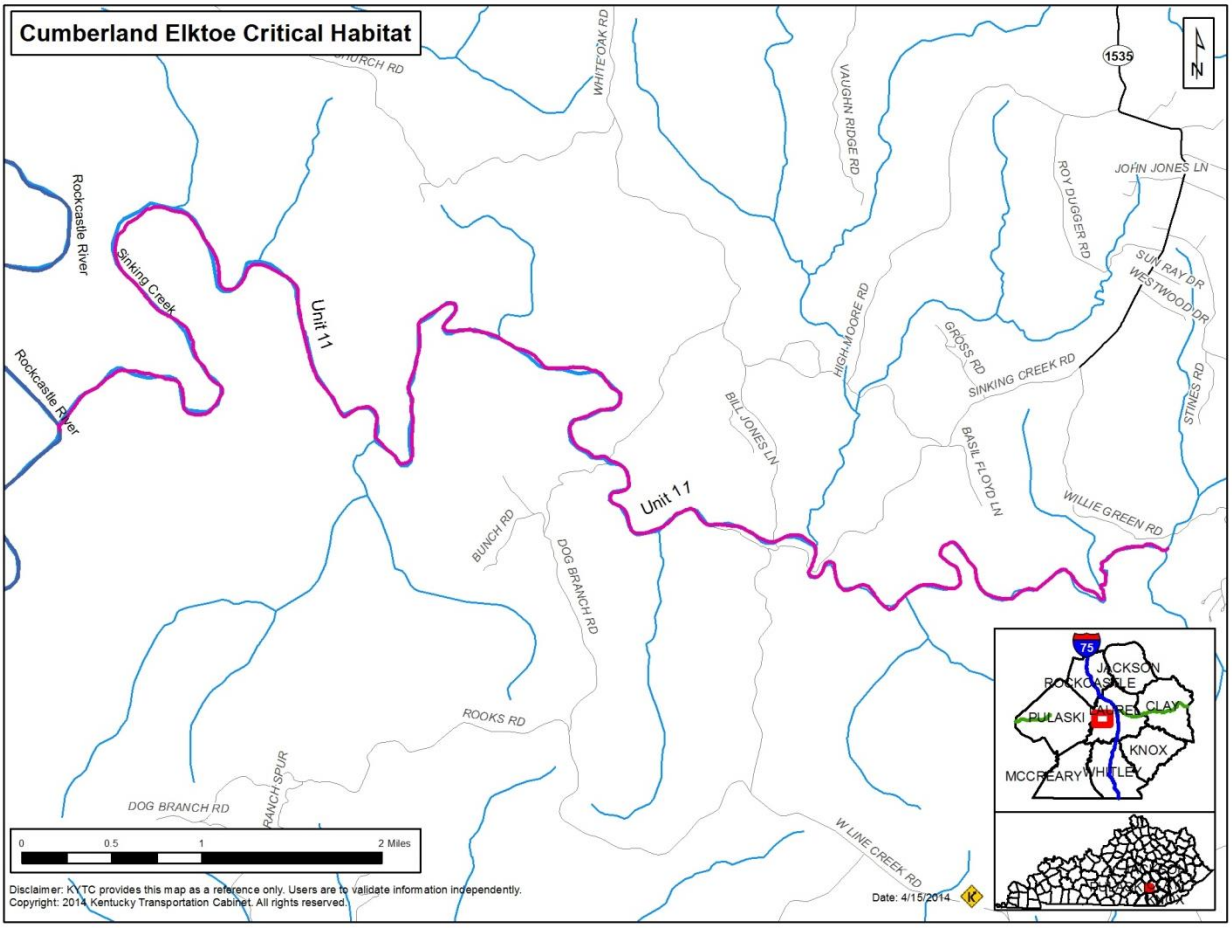
***Unit 9. Big South Fork and Tributaries, Fentress, Morgan, and Scott Counties, Tennessee, and McCreary County, Kentucky.***

Unit 9 encompasses 153 rkm (95 rmi) and consists of 43 rkm (27 rmi) of the Big South Fork of the Cumberland River main stem from its confluence with Laurel Crossing Branch downstream of Big Shoals, McCreary County, Kentucky, upstream to its confluence with the New River and Clear Fork, Scott County, Tennessee; 11 rkm (7 rmi) of North White Oak Creek from its confluence with the Big South Fork upstream to Panther Branch, Fentress County, Tennessee; 14.5 rkm (9.0 rmi) of the New River from its confluence with Clear Fork upstream to U.S. Highway 27, Scott County, Tennessee; 40 rkm (25 rmi) of Clear Fork from its confluence with the New River upstream to its confluence with North Prong Clear Fork, Morgan and Fentress Counties, Tennessee; 10 rkm (6 rmi) of White Oak Creek from its confluence with Clear Fork upstream to its confluence with Bone Camp Creek, Morgan County, Tennessee; 6 rkm (4 rmi) of Bone Camp Creek from its confluence with White Oak Creek upstream to Massengale Branch, Morgan County, Tennessee; 14.5 rkm (9.0 rmi) of Crooked Creek from its confluence with Clear Fork upstream to Buttermilk Branch, Fentress County, Tennessee; and 14.5 rkm (9 rmi) of North Prong Clear Fork from its confluence with Clear Fork upstream to Shoal Creek, Fentress County, Tennessee.

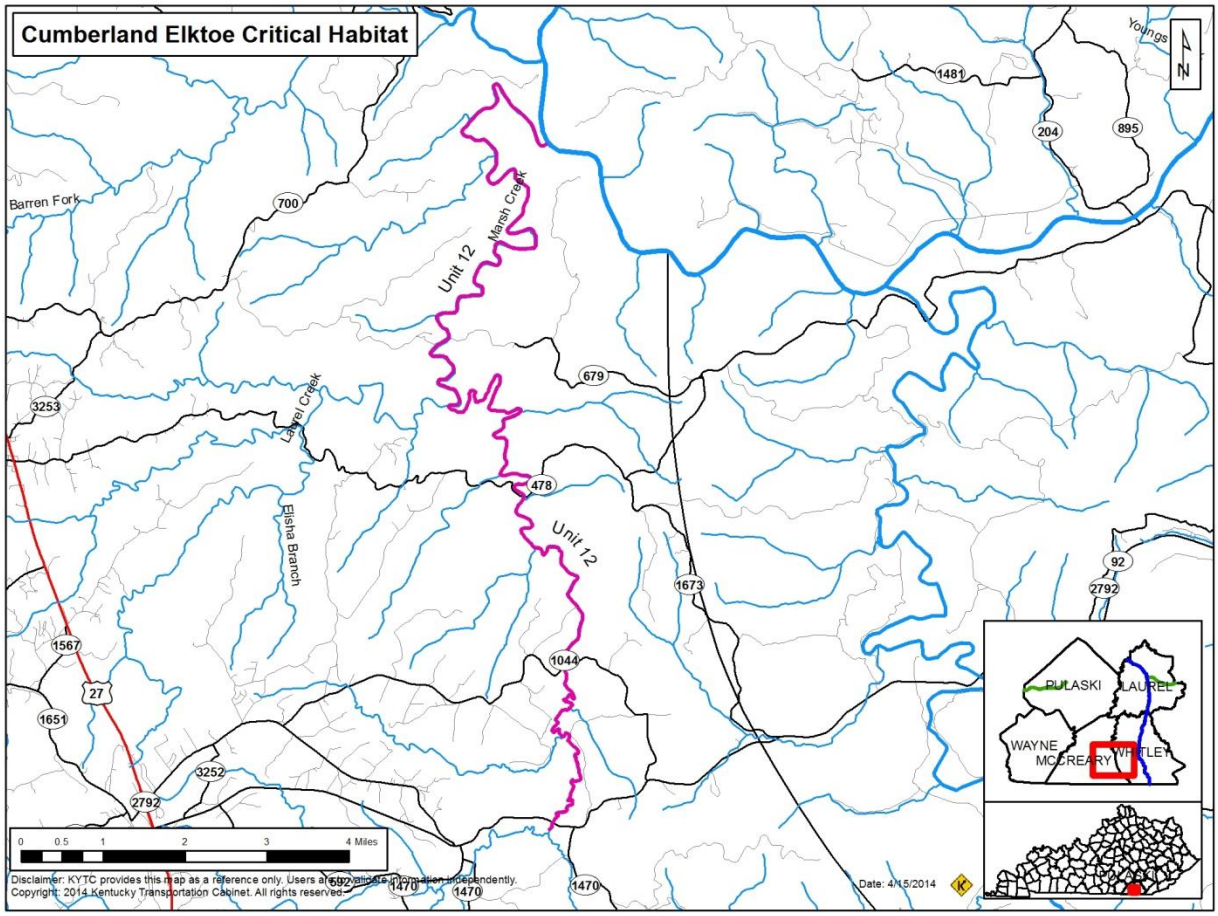


***Unit 11. Sinking Creek, Laurel County, Kentucky.***

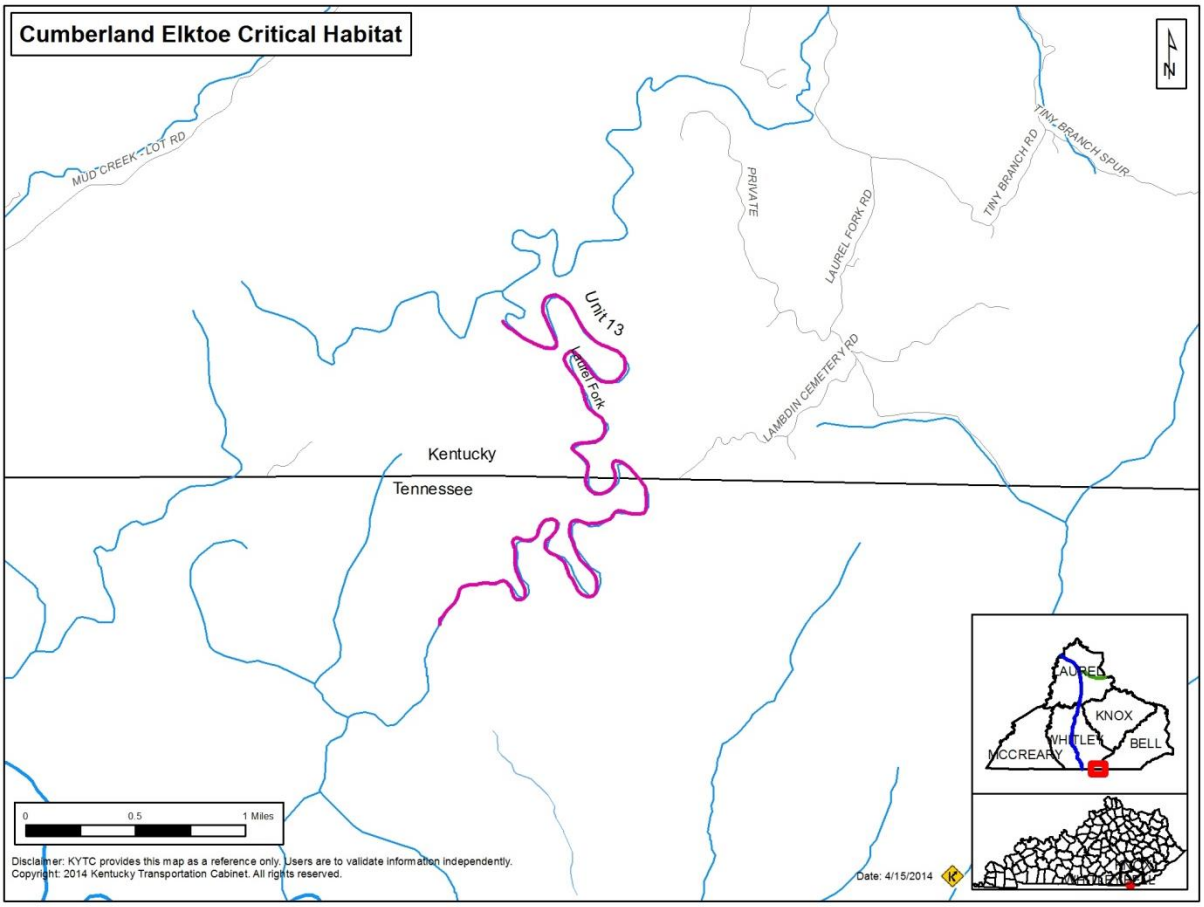
Unit 11 encompasses 13 rkm (8 rmi) and extends from the Sinking Creek/ Rockcastle River confluence upstream to Sinking Creek's confluence with Laurel Branch in Laurel County, Kentucky.



***Unit 12. Marsh Creek, McCreary County, Kentucky.***
Unit 12 includes 24 rkm (15 rmi) and consists of Marsh Creek from its confluence with the Cumberland River upstream to the State Road 92 Bridge in McCreary County, Kentucky.



***Unit 13. Laurel Fork, Claiborne County, Tennessee, and Whitley County, Kentucky.***
Unit 13 includes 8 rkm (5 rmi) of Laurel Fork of the Cumberland River from the Campbell/Claiborne County line upstream 11.0 rkm (6.9 rmi) through Claiborne County, Tennessee, to Whitley County, Kentucky. The upstream terminus is 3 rkm (2 rmi) upstream of the Kentucky/Tennessee State line.



# Cumberlandian Combshell (*Epioblasma brevidens*)

Photo courtesy: http://www.dinkinsbiological.com/virginia.html

## Species Description

The Cumberlandian combshell (*Epioblasma brevidens*) was listed as **endangered** in 1997.

The Cumberlandian combshell has a thick solid shell with a smooth to cloth-like periostracum, which is yellow to tawny brown in color with narrow green broken rays. The nacre is white. The shells of females are inflated, with serrated teeth-like structures along a portion of the shell margin. Umbo is even with the hinge line. Cardinal teeth are large and serrated; lateral teeth thick and slightly curved. Length 2-3 inches.

## Habitat Description

The Cumberlandian combshell inhabits **large streams to large rivers**. It is often found in water depths of less than 3 feet in clear, clean water of sand, gravel, or rocky substrates. It is absent from smaller tributary type streams.

## Critical Habitat

Yes (*see additional maps and detailed descriptions provided after the decision key*)

Critical habitat for the Cumberlandian combshell was designated on August 31, 2004.

Primary constituent elements of critical habitat for this species include:

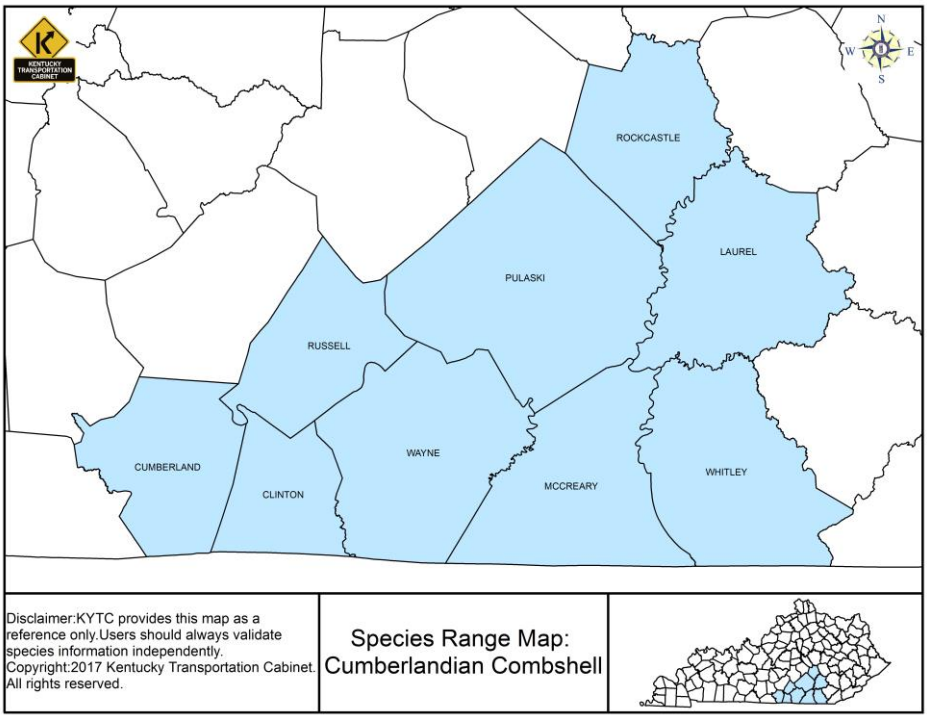
1. Permanent, flowing stream reaches with a flow regime (i.e. the magnitude, frequency, duration, and seasonality of discharge over time) necessary for normal behavior, growth, and survival of all life stages of the five mussels and their host fish.
2. Geomorphically stable stream and river channels and banks (structurally stable stream cross section).
3. Stable substrates, consisting of mud, sand, gravel, and/or cobble/ boulder, with low amounts of fine sediments or attached filamentous algae.
4. Water quality (including temperature, turbidity, oxygen content, and other characteristics) necessary for the normal behavior, growth, and survival of all life stages of the mussels and their host fish.
5. Fish hosts with adequate living, foraging, and spawning areas.

| Species, Stream (unit), and State | Currently Occupied River Miles | Currently Unoccupied River Miles |
|---|---|---|
| **Cumberlandian Combshell** | | |
| Duck River (Unit 1), TN | ..... | 46 |
| Bear Creek (Unit 2), AL, MS | 25 | ..... |
| Powell River (Unit 4), TN, VA | 94 | ..... |
| Clinch River (Unit 5), TN, VA | 148 | ..... |
| Nolichucky River (Unit 6), TN | ..... | 5 |
| Big South Fork (Unit 9), TN, KY | 27 | ..... |
| Buck Creek (Unit 10), KY | 36 | ..... |

## Range

The Cumberlandian combshell has been extirpated from a large percentage of its former range. Main-stem populations in both the Cumberland and Tennessee Rivers are now considered extirpated. This species has apparently also been largely eliminated from numerous tributaries in the Cumberland River system (e.g., Rockcastle River, Beaver Creek, Obey River, Caney Fork, Stones River, Red River) and the Tennessee River system (e.g., Station Creek, Wallen Creek, Holston River, Nolichucky River, West Prong Little Pigeon River, Little Tennessee River, Paint Rock River, Elk River, Little Bear Creek, Cedar Creek, Duck River). The Cumberlandian combshell has also been extirpated from large portions of additional tributaries in the Cumberlandian Region (e.g., Clinch River, Powell River, North Fork Holston River, Bear Creek).

Extant Cumberland River system populations occur in Buck Creek, Pulaski County, Kentucky; and Big South Fork, Scott County, Tennessee, and McCreary County, Kentucky. In the Tennessee River system, populations are thought to remain in the Clinch River, Scott County, Virginia, and Hancock County, Tennessee; Powell River, Lee County, Virginia, and Claiborne and Hancock Counties, Tennessee; and Bear Creek, Colbert County, Alabama, and Tishimingo County, Mississippi. Non-essential, experimental populations have been established in the Tennessee River in Alabama, and in portions of the French Broad and Holston Rivers in Tennessee.



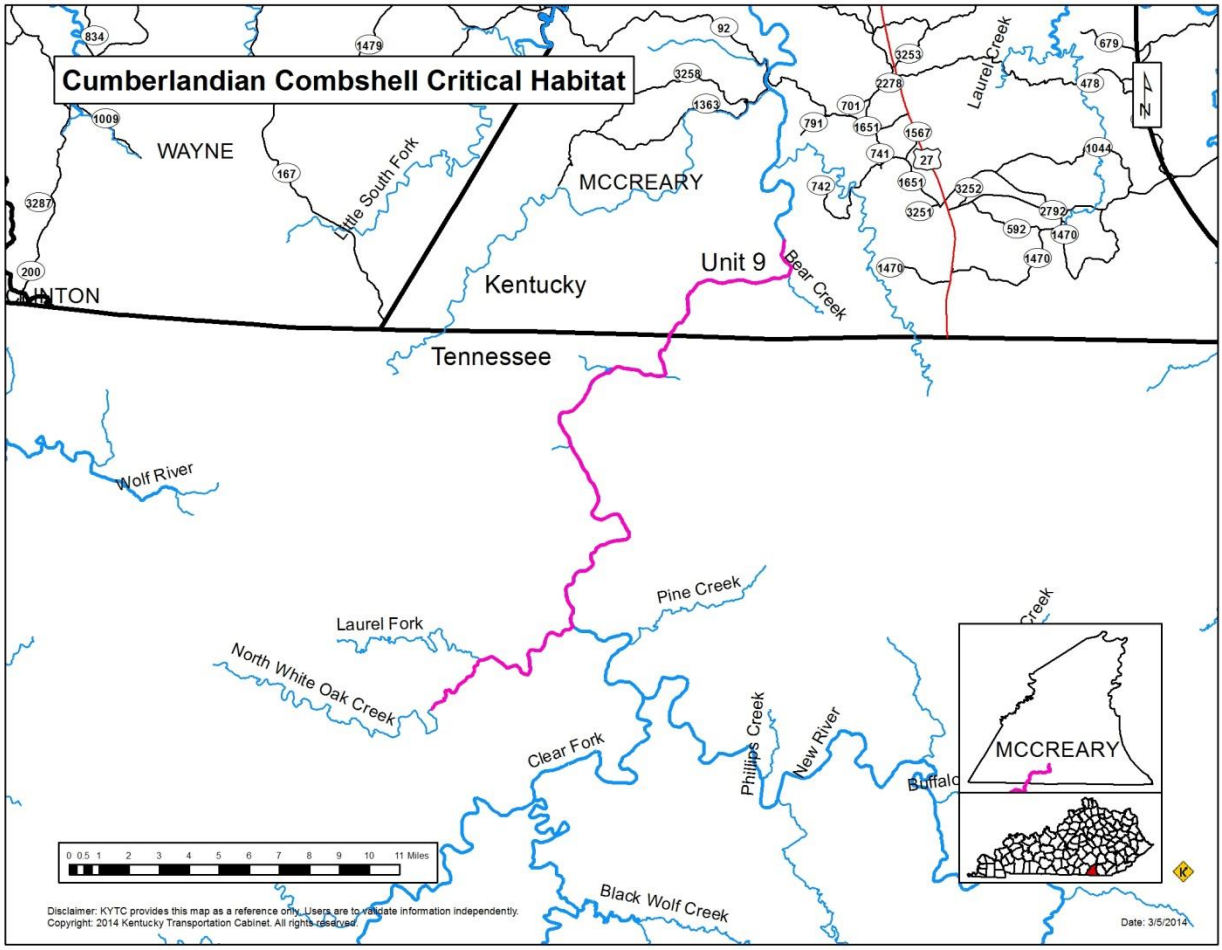
## Decision Key

1) Does the project include any direct or indirect effects to **large streams, to large rivers or their nearby tributaries**? (e.g. – remove riparian vegetation, alter stream banks, change water levels/flow, dredge, construct/remove bridge piers, etc.)

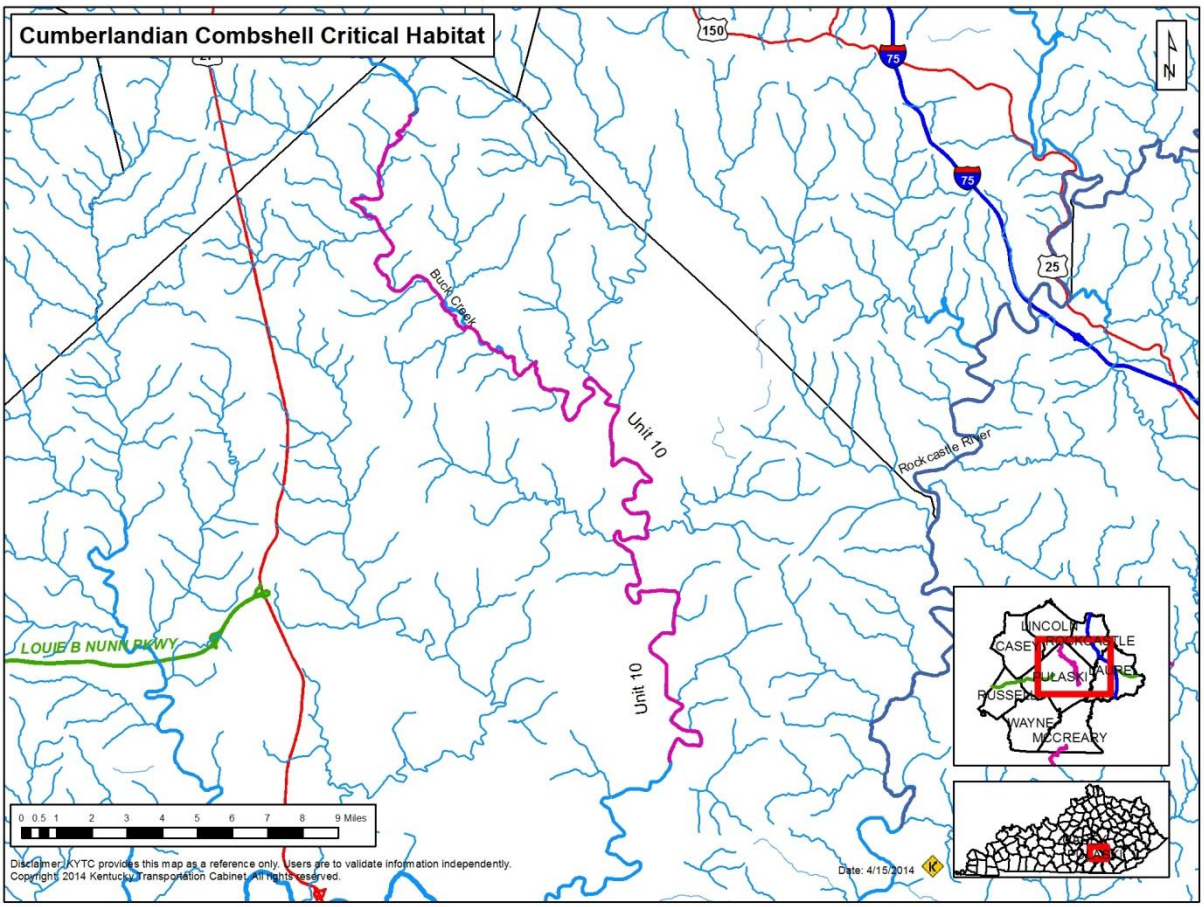
    a. Yes: Contact SME
    b. No: Prepare NE finding

***Unit 9. Big South Fork and Tributaries, Fentress, Morgan, and Scott Counties, Tennessee, and McCreary County, Kentucky.***

Unit 9 encompasses 153 rkm (95 rmi) and consists of 43 rkm (27 rmi) of the Big South Fork of the Cumberland River main stem from its confluence with Laurel Crossing Branch downstream of Big Shoals, McCreary County, Kentucky, upstream to its confluence with the New River and Clear Fork, Scott County, Tennessee; 11 rkm (7 rmi) of North White Oak Creek from its confluence with the Big South Fork upstream to Panther Branch, Fentress County, Tennessee; 14.5 rkm (9.0 rmi) of the New River from its confluence with Clear Fork upstream to U.S. Highway 27, Scott County, Tennessee; 40 rkm (25 rmi) of Clear Fork from its confluence with the New River upstream to its confluence with North Prong Clear Fork, Morgan and Fentress Counties, Tennessee; 10 rkm (6 rmi) of White Oak Creek from its confluence with Clear Fork upstream to its confluence with Bone Camp Creek, Morgan County, Tennessee; 6 rkm (4 rmi) of Bone Camp Creek from its confluence with White Oak Creek upstream to Massengale Branch, Morgan County, Tennessee; 14.5 rkm (9.0 rmi) of Crooked Creek from its confluence with Clear Fork upstream to Buttermilk Branch, Fentress County, Tennessee; and 14.5 rkm (9 rmi) of North Prong Clear Fork from its confluence with Clear Fork upstream to Shoal Creek, Fentress County, Tennessee.



***Unit 10. Buck Creek, Pulaski County, Kentucky.***
Unit 10 encompasses 58 rkm (36 rmi) and includes Buck Creek from the State Route 192 Bridge upstream to the State Route 328 Bridge in Pulaski County, Kentucky. Buck Creek is considered currently occupied by the Cumberlandian combshell.



# Dromedary Pearlymussel (*Dromus dromas*)

## Species Description

The dromedary pearlymussel was listed as **endangered** in 1976.

The species is commonly known as the dromedary mussel, or the camel mussel, because of a distinct hump present near the umbo on big river specimens, which is morphologically different from the headwater form.

Photo Credit: http://www.joelsartore.com/stock/ESA002-00352/

The dromedary pearlymussel is a medium-sized species, rounded to sub-triangular in outline with full, high beaks set forward. Valves are usually solid and inflated. Beak sculpture consists of a series of fine ridges running parallel with growth lines. The outer surface of the shell near the median line has a strong concentric ridge or hump with a curved row of smaller knobs near the midline extending from the umbo area near the ventral margin. The outer covering of the shell is generally yellowish-green in color with broken green rays covering the shell. Further, numerous smaller rays of dots or broken lines mixed with wider green rays or blotches cover the surface of the shell. Cardinal teeth are large and serrated; lateral teeth are thick and short. Length 3-4 inches.

## Habitat Description

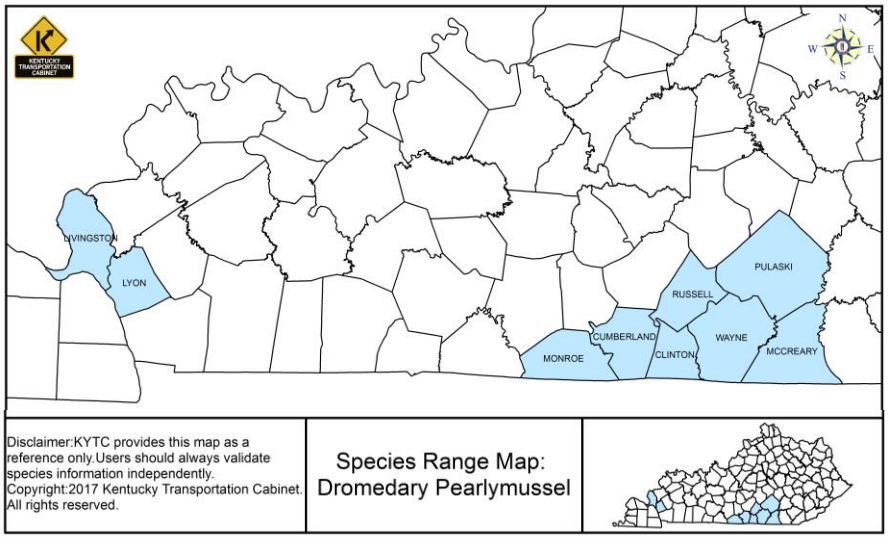
These mussels are usually found in clean, fast-flowing water in substrates that contain relatively firm rubble, gravel, and sand swept free from siltation. These mussels are usually found buried in the substrate in shallow riffle and shoal areas. It can occur from **small, headwater streams to large rivers**.

## Critical Habitat

None

## Range

The dromedary pearlymussel is restricted to the Cumberland and Tennessee Rivers from the major headwater tributary streams as far as Muscle Shoals in northern Alabama. Non-essential, experimental populations have been established in the Tennessee River in Alabama, and in portions of the French Broad and Holston Rivers in Tennessee.




## Decision Key

1) Does the project include any direct or indirect effects to **perennial streams or their nearby tributaries**? (e.g. – remove riparian vegetation, alter stream banks, change water levels/flow, dredge, construct/remove bridge piers, etc.)

    a. Yes: Contact SME
    b. No: Prepare NE finding

# Fanshell Mussel (*Cyprogenia stegaria*)

## Species Description

The fanshell mussel was listed as **endangered** in 1990.

Photo Credit:
http://www.flickr.com/photos/ttravisbrownphotos/8695252379/

The fanshell has a rounded shell that is moderately inflated and thick. The umbo is wide and prominent, and slightly above hinge line. The periostracum is dull, not shiny, with a base color of yellowish to tan, patterned with radiating rows of green rays composed of microscopic flecks. The shell has coarse, concentric growth ridges overlain by numerous small pustules, particularly on the posterior half. These characteristics can vary greatly between individuals. Nacre is white. Cardinal teeth are large and serrated; lateral teeth are thick and short. Length 3-4 inches.

## Habitat Description

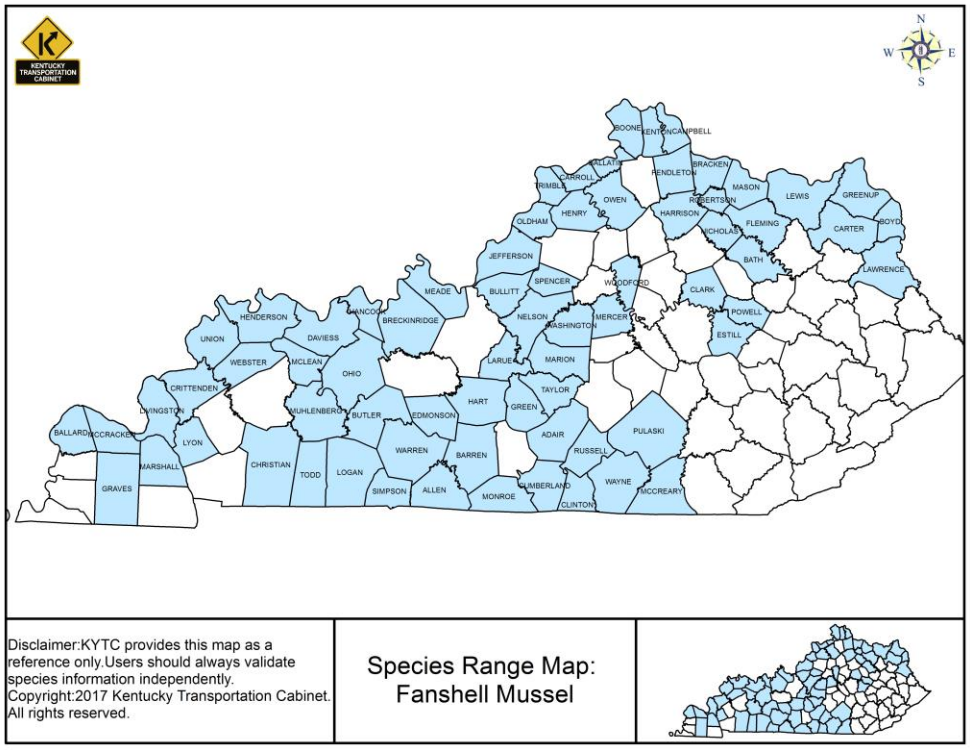
These mussels are most often associated with stable substrates of sand, gravel, and cobble. They are usually found at depths of less than three feet in strongly flowing water in **large streams to large rivers**.

## Critical Habitat

None

## Range

The fanshell was historically widely distributed in the Ohio, Wabash, Cumberland, and Tennessee Rivers and their larger tributaries in Pennsylvania, Ohio, West Virginia, Illinois, Indiana, Kentucky, Tennessee, Alabama, and Virginia. In Kentucky, they are still considered to be potentially occurring in the Ohio, Salt, Licking, Little Sandy, Tygarts, Kentucky, Red, Cumberland, Tennessee, Green, Barren, and Clarks River systems. They are fairly ubiquitous statewide, but populations are distributed sporadically. The Green and Licking River populations remain two of the best in the nation for this species. Non-essential, experimental populations have been established in portions of the French Broad and Holston Rivers in Tennessee.




## Decision Key

1) Does the project include any direct or indirect effects to **large streams, to large rivers or their nearby tributaries**? (e.g. – remove riparian vegetation, alter stream banks, change water levels/flow, dredge, construct/remove bridge piers, etc.)

    a. Yes: Contact SME
    b. No: Prepare NE finding

# Fat Pocketbook Mussel (*Potamilus capax)*

## Species Description

The fat pocketbook was listed as **endangered** in 1976.

Photo Credit:
http://wwx.inhs.illinois.edu/collections/mollusk/publications/guide/index/128

The shell of the fat pocketbook is round to oval, greatly inflated, and moderately thin. Anterior and posterior margins are rounded. Umbos are greatly inflated and elevated above the hinge line. There are small wings anterior and posterior to the umbo. The shell is smooth, shiny, rayless, and yellow, tan, olive, or dark brown in color. Cardinal teeth are thin and blade like; later teeth are thin and curved. The nacre is white, sometimes with a tinge of pink. Length 4-5 inches.

## Habitat Description

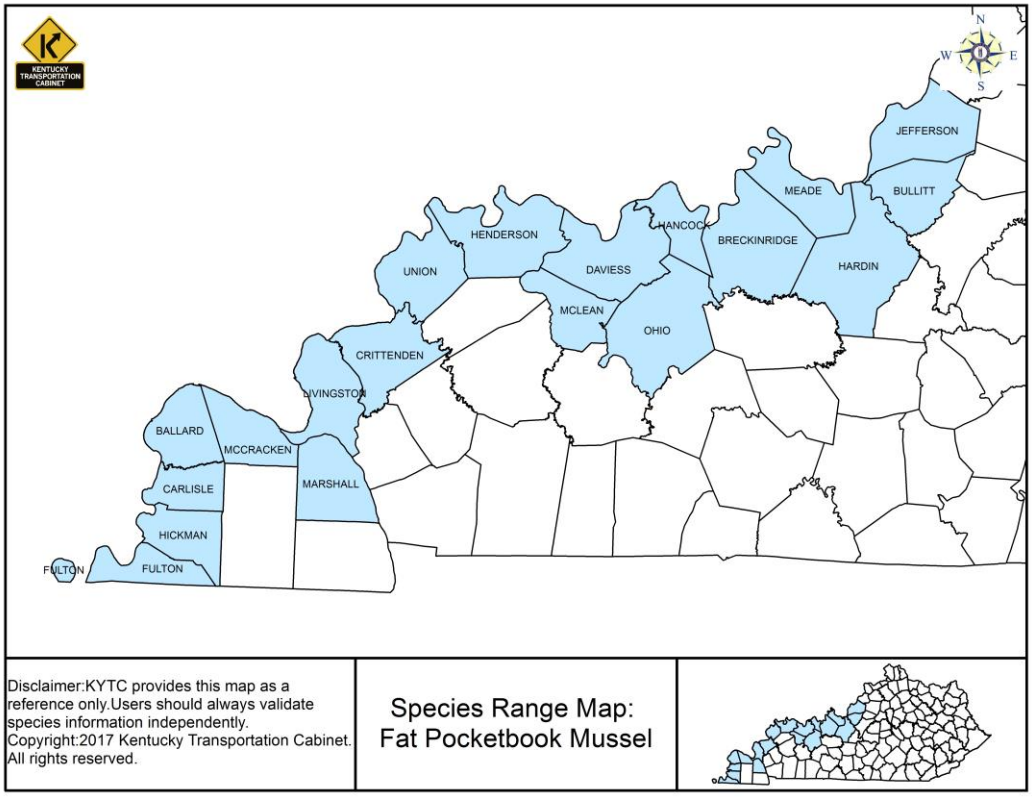
The fat pocketbook is most commonly found in a mixture of sand, clay, and silt, which is referred to as "sticky mud." This "sticky mud' substrate can be 100cm deep and virtually impossible to walk through. Because of its very thin and globose shell, fat pocketbook tolerates deep deposits of fine-grained silt substratum and would not survive in gravel substratum with erosive flows--habitats usually dominated by heavy, thick-shelled bivalves. Historically, the fat pocketbook was probably most common in large river sloughs and oxbows with silt substratum, which were more common at the mouths of rivers before developments such as locks, dams, levees, and bank protection measures. The fat pocketbook can still be common in deep deposits of fine-grained sediments in man-made ditches or in slow moving rivers, streams, sloughs, and bayous.

## Critical Habitat

None

## Range

Although range maps depict this species along the Ohio and Wabash Rivers, large numbers of this species have not been reported outside the St. Francis watershed (Missouri and Arkansas). However, it is likely that the fat pocketbook can still be found in waters adjacent to the Ohio River in Kentucky.




## Decision Key

1) Does the project include any direct or indirect effects to any **slow moving or stagnant streams/rivers/waterbodies or their nearby tributaries**? (e.g. – remove riparian vegetation, alter stream banks, change water levels/flow, dredge, construct/remove bridge piers, etc.)

    a. Yes: Contact SME
    b. No: Prepare NE finding

# Fluted Kidneyshell (*Ptychobranchus subtentus*)

## Species Description

The fluted kidneyshell was listed as **endangered** in September of 2013.

*Photo Credit: http://marcelomarks50.blogspot.com/2013_04_28_archive.html*

The shape of the shell is roughly oval elongate, and the solid, relatively heavy valves (shells) are moderately inflated. A series of flutings (parallel ridges or grooves) characterizes the posterior slope of each valve. The shell is typically greenish, or brownish-yellow with broad, broken green rays. Cardinal teeth are moderately large; lateral teeth thick and relatively short. Length 3-4 inches.

## Habitat Description

The fluted kidneyshell occurs in **small streams to medium-sized rivers**, inhabiting sand and gravel substrates in relatively shallow riffles and shoals with moderate to swift current. In comparison to some co-occurring species, the fluted kidneyshell demonstrates strong habitat specificity by being associated with faster flows, greater shear stress (force of water pressure and velocity on the substrate), and low substrate embeddedness, usually at depths of less than 2 feet.

## Critical Habitat

Yes (*see additional maps and detailed descriptions provided after the decision key*)

Critical habitat was designated for the fluted kidneyshell on September 26, 2013.

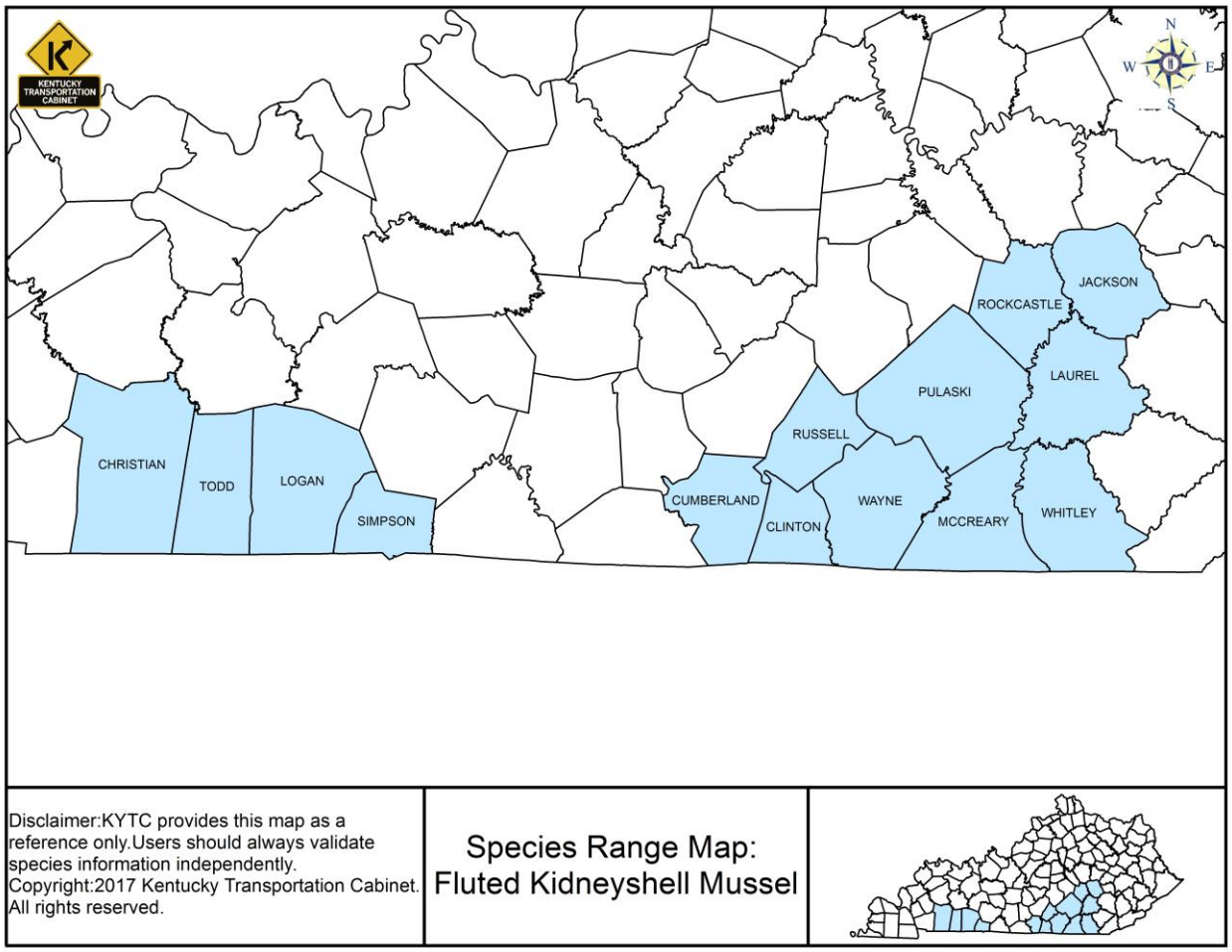
Primary constituent elements for the fluted kidneyshell include:

1. Riffle habitats within large, geomorphically stable stream channels (channels that maintain lateral dimensions, longitudinal profiles, and sinuosity patterns over time without an aggrading or degrading bed elevation).
2. Stable substrates of sand, gravel, and cobble with low to moderate amounts of fine sediment and containing flow refugia with low shear stress.
3. A natural hydrologic flow regime (the magnitude, frequency, duration, and seasonality of discharge over time) necessary to maintain benthic habitats where the species are found, and connectivity of rivers with the floodplain, allowing the exchange of nutrients and sediment for habitat maintenance, food availability for all life stages, and spawning habitat for native fishes.
4. Water quality with low levels of pollutants and including a natural temperature regime, pH (between 6.0 and 8.5), oxygen content (not less than 5.0 milligrams per liter (mg/L)), hardness, and turbidity necessary for normal behavior, growth, and viability of all life stages.
5. The presence of abundant fish hosts, which may include the barcheek darter, fantail darter, rainbow darter, redline darter, bluebreast darter, dusky darter and banded sculpin, necessary for recruitment of the fluted kidneyshell.

| Species, Stream (unit), and State | Currently Occupied River Miles | Currently Unoccupied River Miles |
|---|---|---|
| **Fluted Kidneyshell** | | |
| Horse Lick Creek (FK1), KY | 12.4 | ..... |
| Middle Fork Rockcastle River (FK2), KY | 7.7 | ..... |
| Rockcastle River (FK3), KY | ..... | 43.5 |
| Buck Creek (FK4), KY | 37.9 | ..... |
| Rock Creek (FK5), KY | 11.9 | ..... |
| Little South Fork Cumberland River (FK6), KY | 40.7 | ..... |
| Big South Fork Cumberland River (FK7), KY | 56.9 | ..... |
| * Units FK8 - FK24 are not in KY | | |

## Range

The fluted kidneyshell is a Cumberlandian Region mussel, meaning it is restricted to the Cumberland (in Kentucky and Tennessee) and Tennessee (in Alabama, Kentucky, Tennessee, and Virginia) River systems.

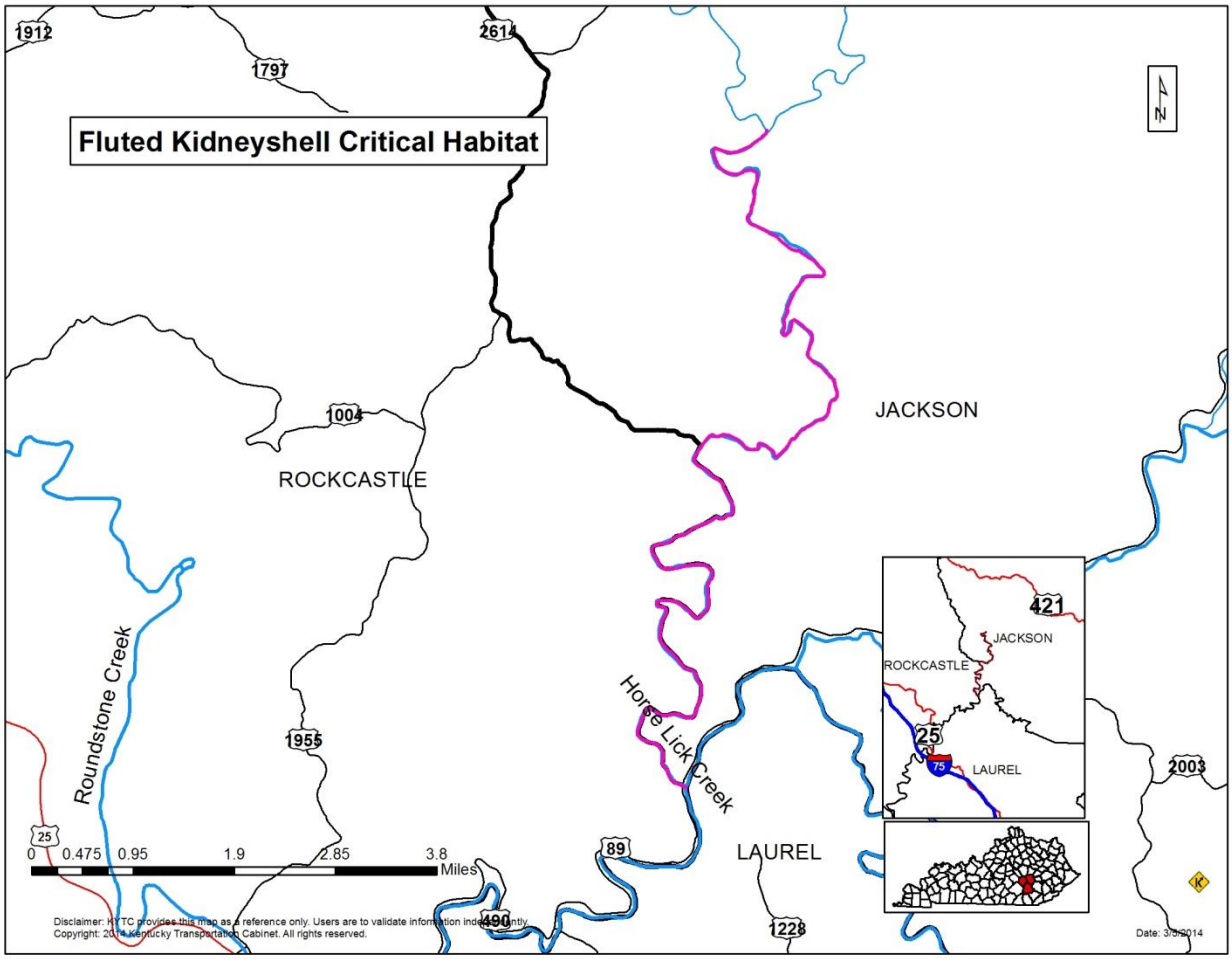



## Decision Key

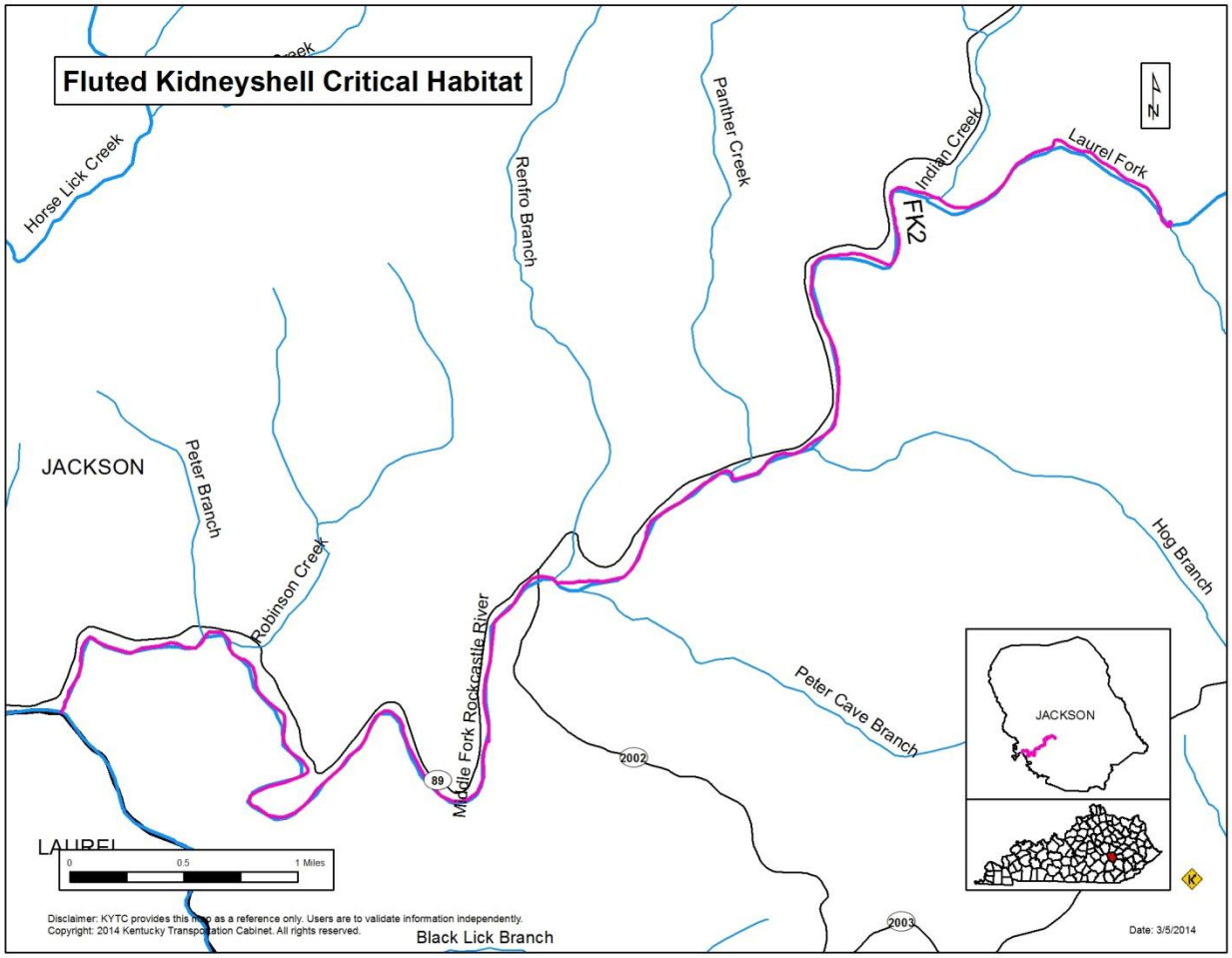
1) Does the project include any direct or indirect effects to **perennial streams or their nearby tributaries**? (e.g. – remove riparian vegetation, alter stream banks, change water levels/flow, dredge, construct/remove bridge piers, etc.)

    a. Yes: Contact SME
    b. No: Prepare NE finding

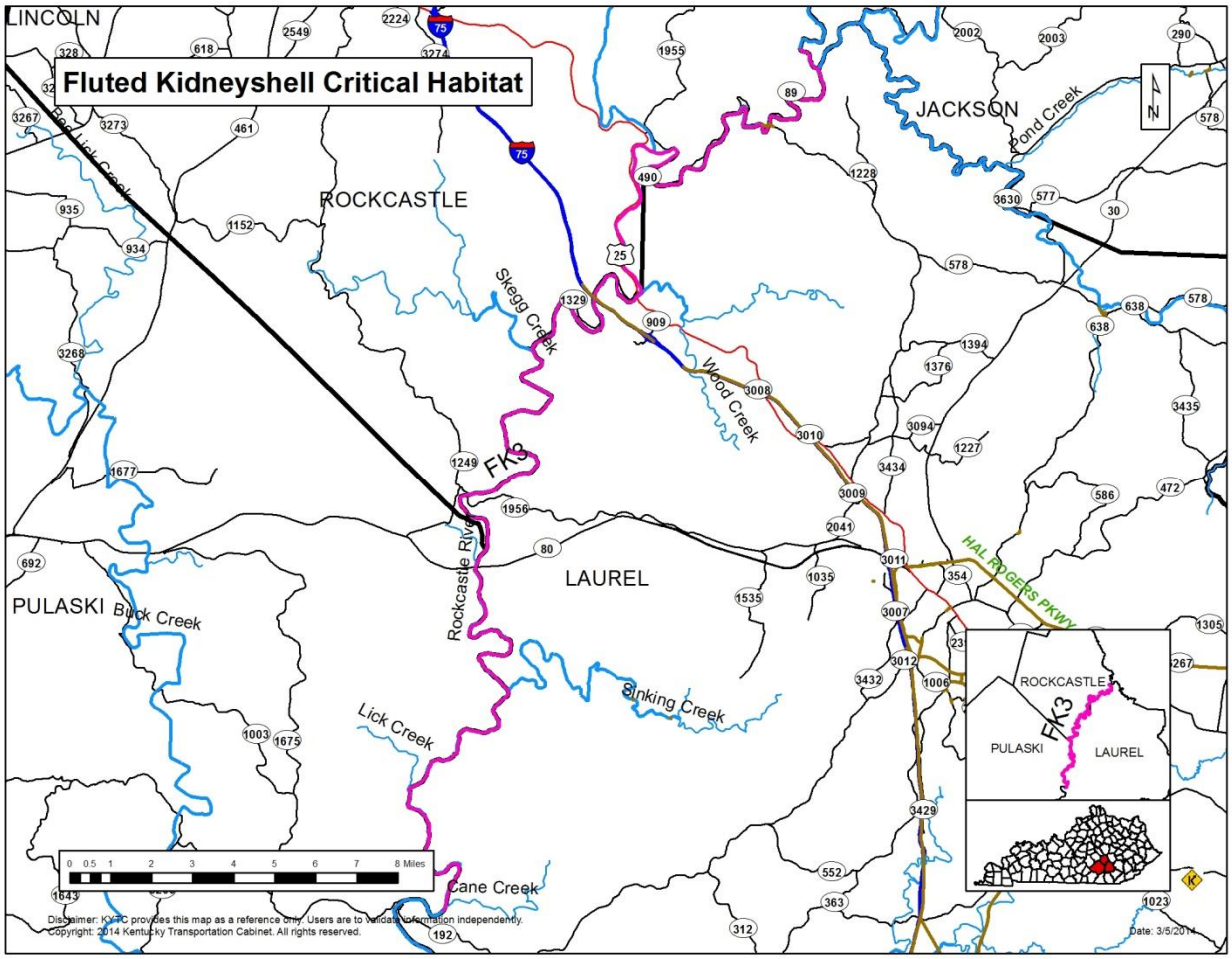
***Unit FK1: Horse Lick Creek, Rockcastle and Jackson Counties, Kentucky.***
Unit FK1 encompasses approximately 19 rkm (12 rmi) of Horse Lick Creek, in Rockcastle and Jackson Counties, KY. It includes the mainstem of Horse Lick Creek from its confluence with the Rockcastle River upstream to Clover Bottom Creek.



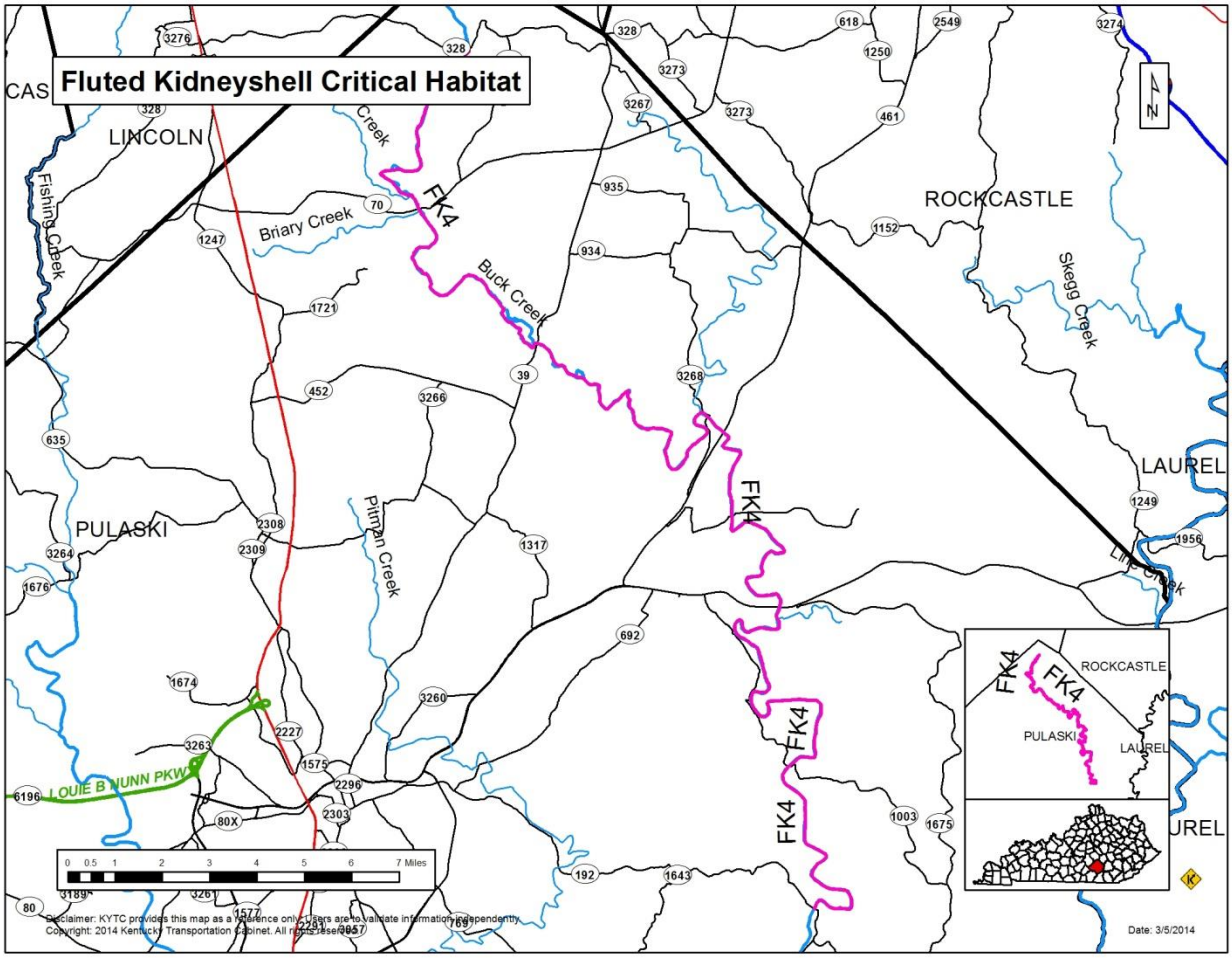
***Unit FK2: Middle Fork Rockcastle River, Jackson County, Kentucky.***
Unit FK2 includes 12.5 rkm (7.7 rmi) of the Middle Fork Rockcastle River from its confluence with the Rockcastle River upstream to its confluence with Indian Creek and Laurel Fork in Jackson County, KY.



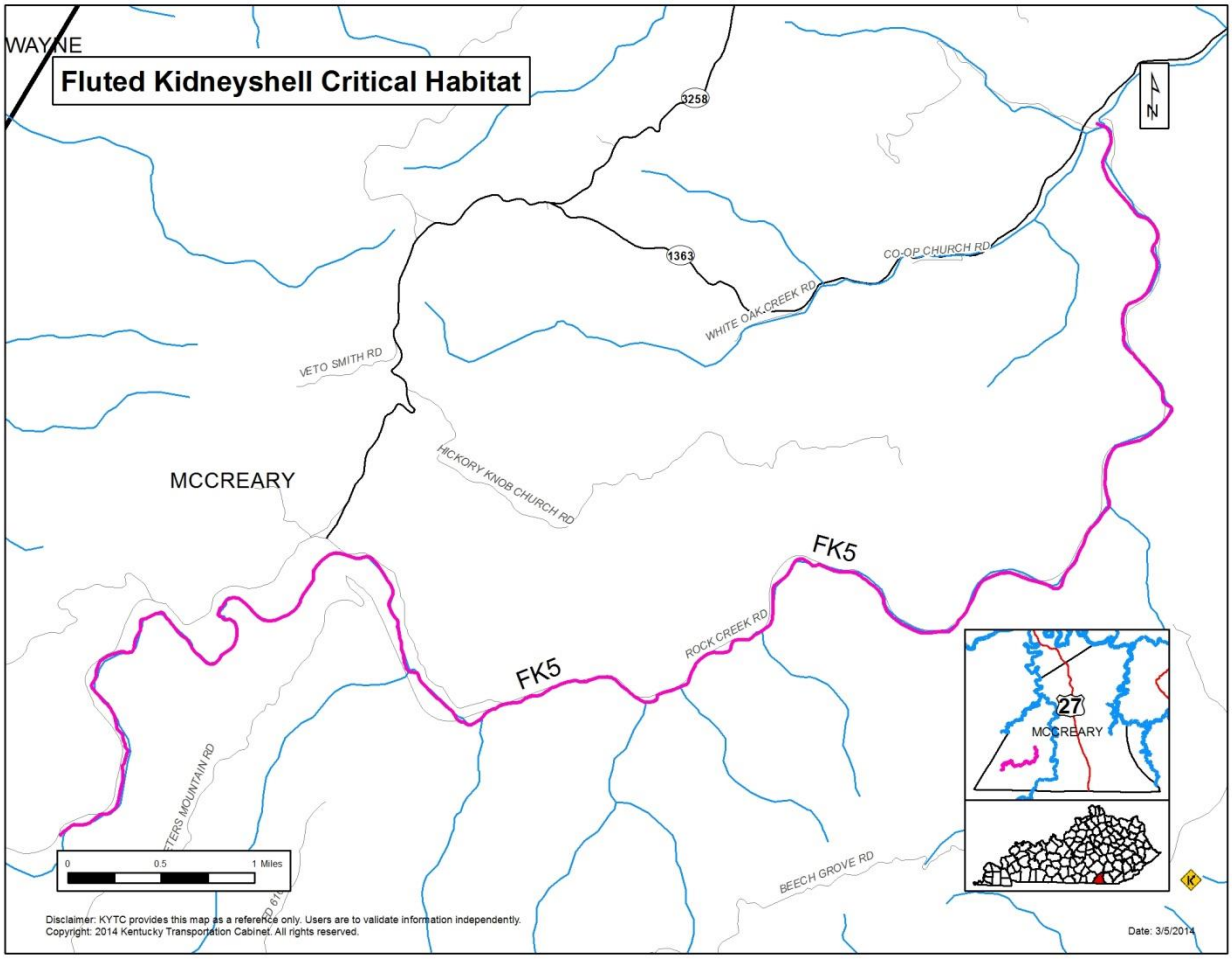
***Unit FK3: Rockcastle River, Pulaski, Laurel, and Rockcastle Counties, Kentucky.***
Unit FK3 includes approximately 70 rkm (43 rmi) of the Rockcastle River from the backwaters of Lake Cumberland near its confluence with Cane Creek along the Laurel and Pulaski County line, KY, upstream to its confluence with Horse Lick Creek along the Laurel and Rockcastle County line, KY.



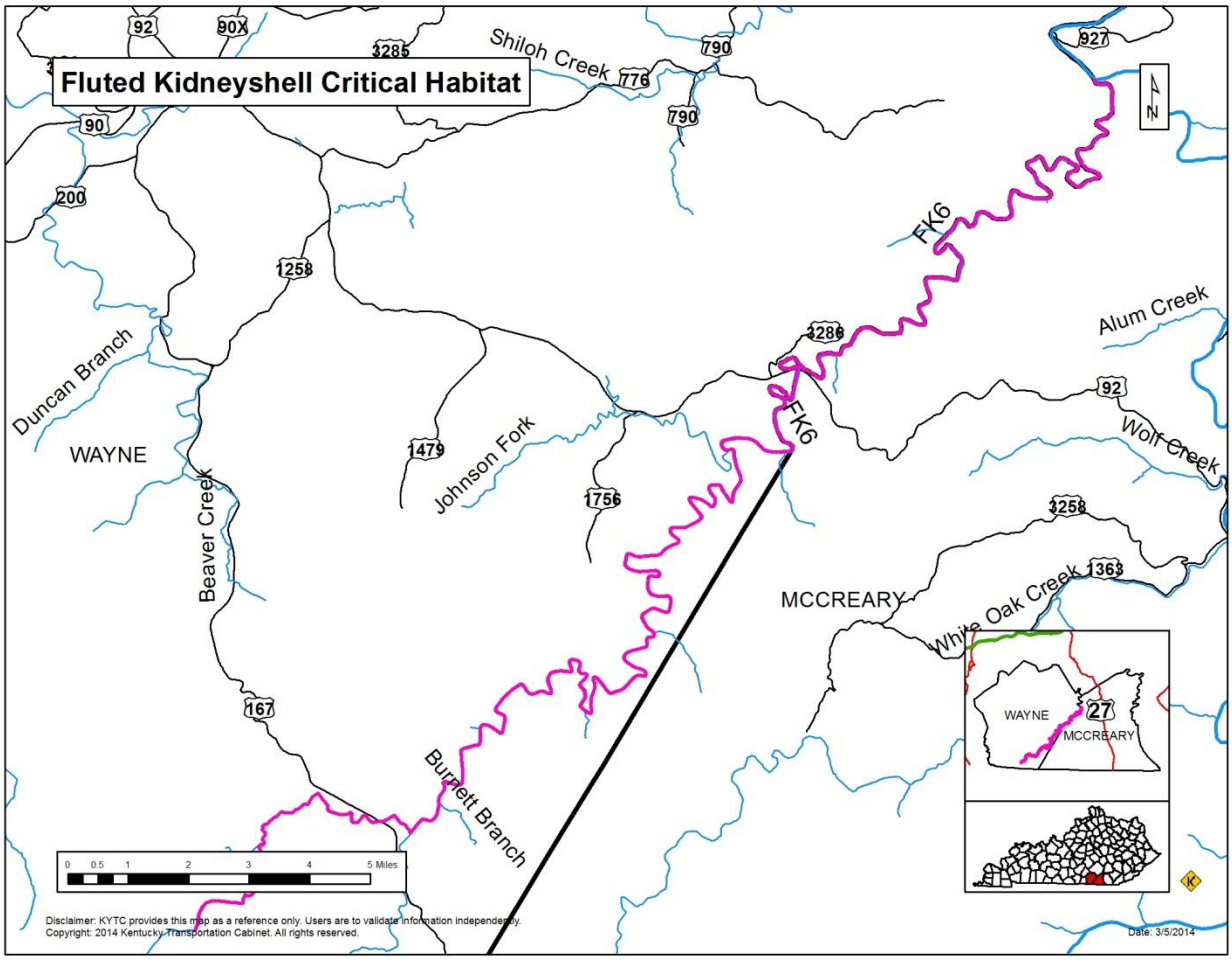
***Unit FK4: Buck Creek, Pulaski County, Kentucky.***
Unit FK4 includes approximately 61 rkm (38 rmi) of Buck Creek from State Route 192 upstream to Route 328, Pulaski County, KY.



***Unit FK5: Rock Creek, McCreary County, Kentucky.***
Unit FK5 includes approximately 19 rkm (12 rmi) of Rock Creek from its confluence with White Oak Creek upstream to the low water crossing at rkm 25.6 (rmi 15.9) in McCreary County, KY.

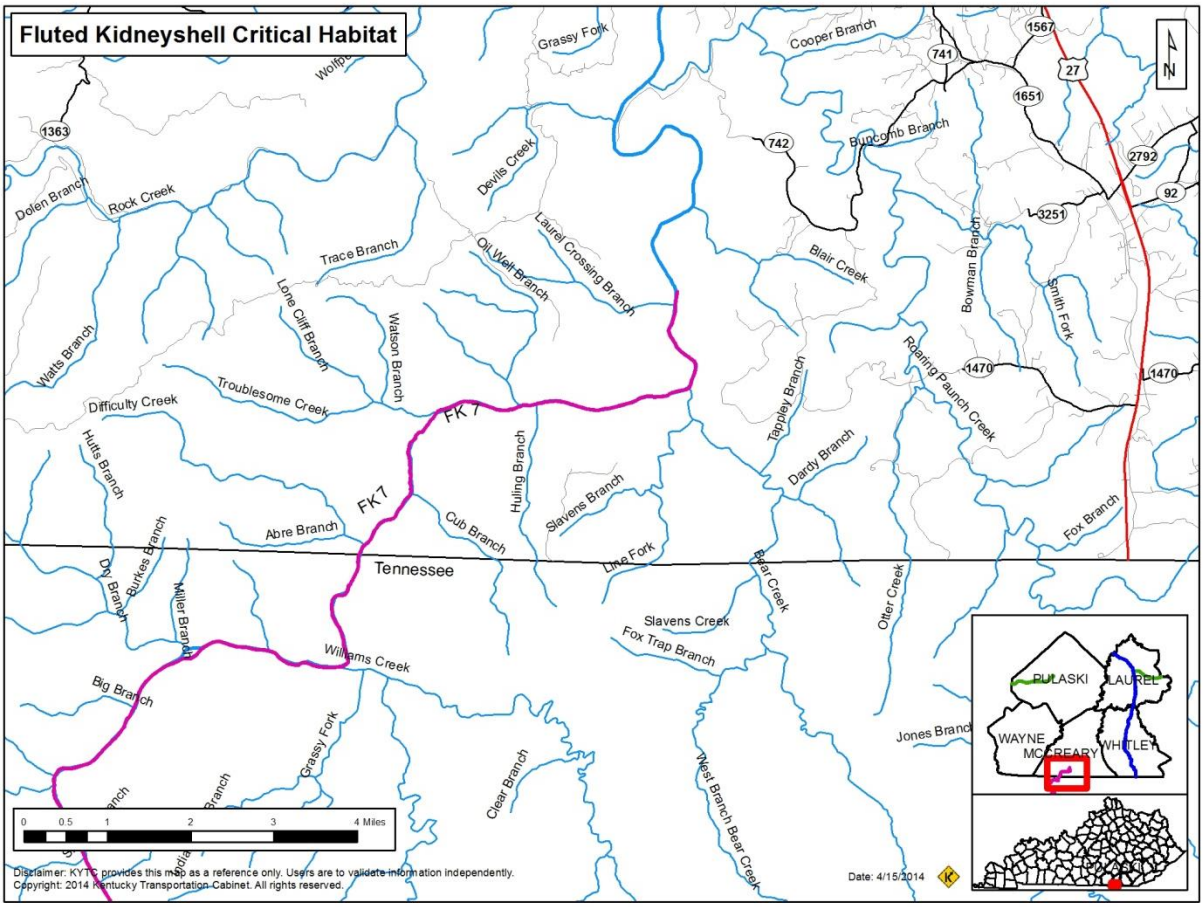


***Unit FK6: Little South Fork Cumberland River, McCreary and Wayne Counties, Kentucky.***
Unit FK6 includes 65.5 rkm (40.7 rmi) of the Little South Fork Cumberland River from its confluence with the Big South Fork Cumberland River, where it is the dividing line between Wayne and McCreary Counties, upstream to its confluence with Dobbs Creek in Wayne County, KY.



***Unit FK7: Big South Fork Cumberland River, Fentress, Morgan, and Scott Counties, Tennessee, and McCreary County, Kentucky.***

Unit FK7 includes a combined total of approximately 92 rkm (57 rmi) of the Big South Fork of the Cumberland River, Clear Fork of the New River, and the New River in Tennessee and Kentucky. Unit FK7 includes approximately 45 rkm (28 rmi) of the Big South Fork Cumberland River from its confluence with Laurel Crossing Branch downstream of Big Shoals, McCreary County, KY, upstream to its confluence with Clear Fork and of the New River, Scott County, TN. This unit also includes 32.3 rkm (20.0 rmi) of Clear Fork from its confluence with theBig South Fork and New River in Scott County, TN, upstream to its confluence with Crooked Creek along the Fentress and Morgan County line, TN. This unit also includes 14.7 rkm (9.1 rmi) of the New River from its confluence with the Big South Fork upstream to the Highway 27 Bridge crossing in Scott County, TN.



# Littlewing Pearlymussel (*Pegias fabula*)

## Species Description

The littlewing pearlymussel was listed as **endangered** on November 14, 1988.

The shell's periostracum is usually eroded, giving the shell a chalky or ashy white appearance. When the periostracum is present, the shell is light green or dark yellowish brown with dark rays of variable width along the shell's anterior surface. It has two posterior ridges separated by a shallow depression, which is diagnostic. Cardinal teeth are large; lateral teeth a thickening of the hinge line. Length 1-1.5 inches.

Photo Credit:
http://www.flickr.com/photos/ttravisbrownphotos/8696365126/

## Habitat Description

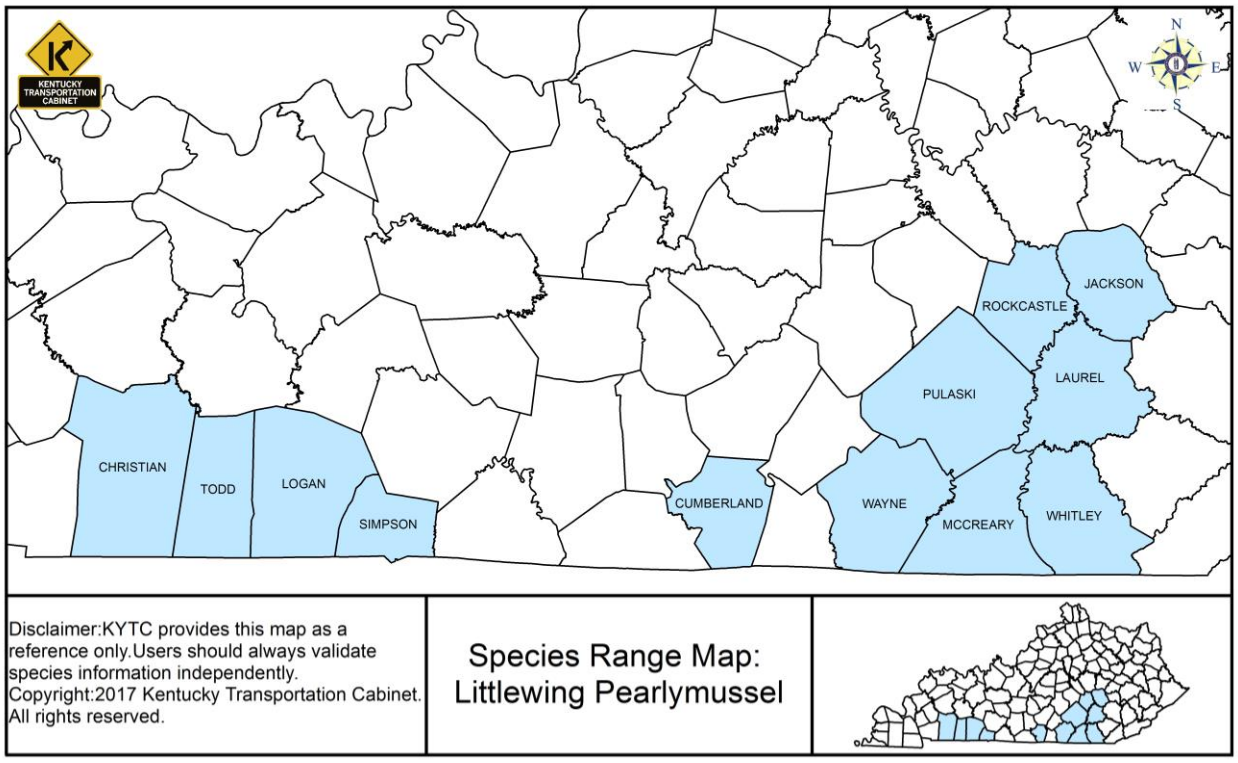
The littlewing pearlymussel inhabits **small to large-sized, low turbidity, cool-water, high to moderate gradient streams** in the Cumberland and Tennessee River basins. They tend to be on top of, or barely buried in the substratum when found during surveys. They can also bury beneath boulders and slab rock in only a small amount of burrowable substrate. Suitable substrate ranges from sand and gravel mixes to areas in between boulders or even cracks in bedrock. It tends to be found in less than one foot of water in or around riffles.

## Critical Habitat

None

## Range

The littlewing pearlymussel occurs in the Cumberland and Tennessee River basins. Most found populations are close to bridges. This may simply be because that is where the most intensive sampling efforts have occurred. The littlewing pearlymussel is a very small mussel that is difficult to locate, even if they are present. This mussel was historically widespread in the Cumberland and Tennessee River systems, but uncommon. Because they tend to lie on top, or bury shallow, in the substrate, when dead it is likely their shells wash away downstream, making it difficult to ascertain actual stretches of river reaches they inhabit. It is rare indeed to find a live specimen.




## Decision Key

1) Does the project include any direct or indirect effects to **perennial streams or their nearby tributaries**? (e.g. – remove riparian vegetation, alter stream banks, change water levels/flow, dredge, construct/remove bridge piers, etc.)

    a. Yes: Contact SME
    b. No: Prepare NE finding

# Northern Riffleshell (*Epioblasma rangiana*)

AKA: *Epioblasma torulosa rangiana*

## Species Description

The northern riffleshell mussel was listed as **endangered** on January 22, 1993.

Photo Credit:
http://wwx.inhs.illinois.edu/collections/mollusk/publications/guide/index/168/

The northern riffleshell are yellowish brown or green in color, and exhibit strong sexual dimorphism. Males tend to be oblong with a wide shallow sulcus running along the posterior ridge from the umbo to the ventral margin. Females have a large expanded and rounded posterior end. Female northern riffleshells appear obovate in outline and swollen/rounded along the post-ventral area of the shell. The periostracum is yellowish brown with numerous fine green rays which may be obscured in older shells. Tubercles on the lateral surface are greatly reduced or absent. The shell is elongate, thick anteriorly, much thinner posteriorly, and compressed. The anterior margin is rounded, while the posterior-ventral margin is broadly rounded in females and indented in males. The umbo is low, and somewhat turned forward with a double-looped beak sculpture and is even with the hinge line. Tubercles or knobs on the lateral surface are greatly reduced or absent. Cardinal teeth are small and serrated; lateral teeth are moderately long and straight. Length 3-4 inches.

## Habitat Description

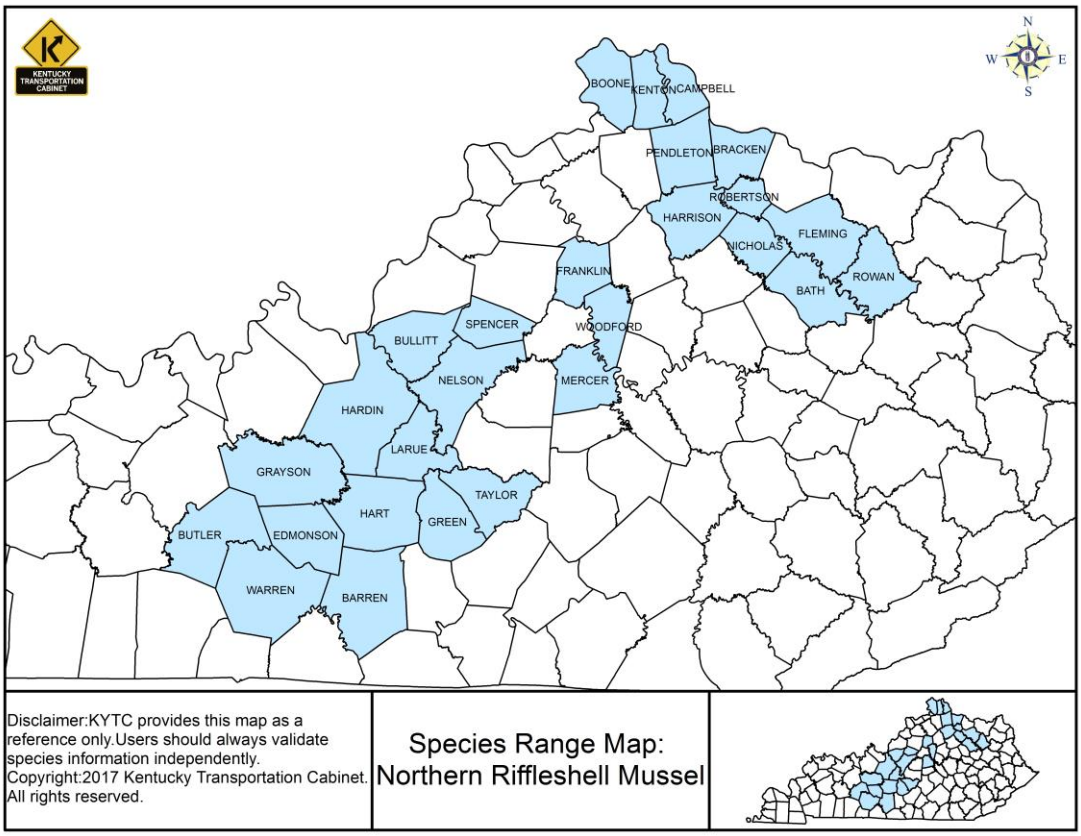
The mussel can be found in **small streams to medium-sized rivers**. The mussel beds are most commonly found in riffles and swift running water with clean substrate bottoms that consist of both firmly packed sand and fine to coarse gravel. Typically the species is found in shallow water, although individuals have been found as deep as two meters (six feet).

## Critical Habitat

None

## Range

In Kentucky, the northern riffleshell was historically in the Ohio, Green, Kentucky, Licking, Salt, and Cumberland Rivers and their associated tributaries. Today, it is considered to occupy only the Licking River. A nonessential, experimental population has now been placed in the Licking River.




## Decision Key

1) Does the project include any direct or indirect effects to **perennial streams or their nearby tributaries**? (e.g. – remove riparian vegetation, alter stream banks, change water levels/flow, dredge, construct/remove bridge piers, etc.)

    a. Yes: Contact SME
    b. No: Prepare NE finding

# Orangefoot Pimpleback (*Plethobasus cooperianus)*

## Species Description

*Photo courtesy:*
*http://wwx.inhs.illinois.edu/collections/mollusk/publications/guide/index/54*

The orangefoot pimpleback was listed as **endangered** in 1976.

The shell is moderately heavy and thick, oval to triangular, and moderately inflated. Shell is reddish-brown to yellowish-brown with numerous, irregular, raised pustules on the posterior two-thirds of the shell. Green rays typical of juveniles become obliterated as individuals mature. Umbo is anterior and extends above hinge line. Cardinal teeth are large and serrated; lateral teeth are thick and short. As the name suggest, the foot of this mussel is orange. Length 3-4 inches.

## Habitat Description

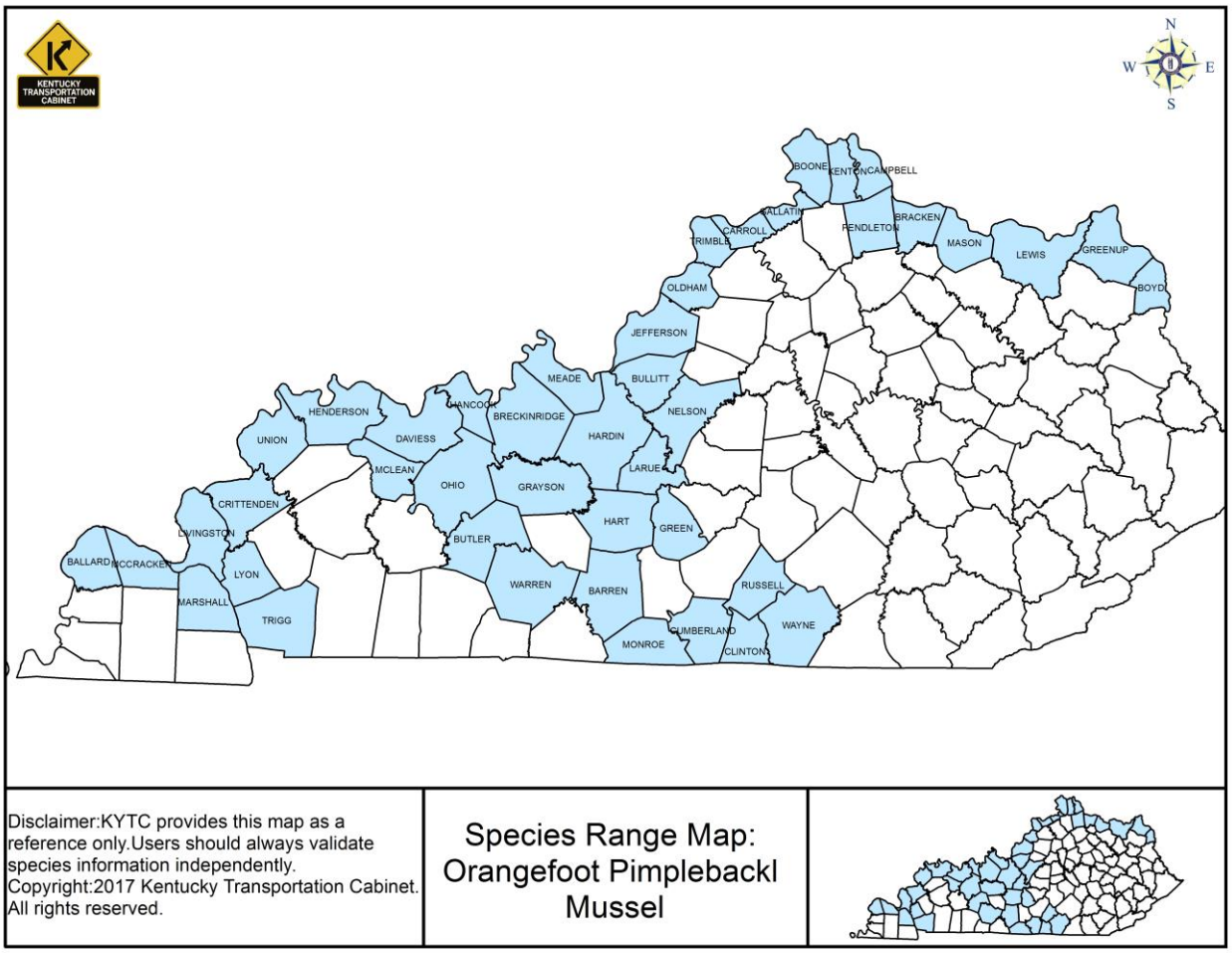
Habitat for this mussel is **medium to large-sized rivers** in sand and gravel with flowing water. Typical water depth for this species ranges from 12 – 18 feet, although it may be found in deeper or shallower water.

## Critical Habitat

None

## Range

The orangefoot pimpleback ranges throughout the Cumberland, Green, Tennessee, and Ohio River systems in Kentucky. A non-essential, experimental population has been established in portions of the French Broad and Holston Rivers in Tennessee.




## Decision Key

1) Does the project include any direct or indirect effects to any **medium to large rivers or their nearby tributaries**? (e.g. – remove riparian vegetation, alter stream banks, change water levels/flow, dredge, construct/remove bridge piers, etc.)

    a. Yes: Contact SME
    b. No: Prepare NE finding

# Oyster Mussel (*Epioblasma capsaeformis*)

Photo Credit: http://www.arkive.org/oyster-mussel/epioblasma-capsaeformis/image-G75628.html

## Species Description

The oyster mussel was listed as **endangered** in 1997.

The oyster mussel has a periostracum that is dull to sub-shiny yellowish to green in color, with numerous narrow dark green rays. The shells of females are expanded along the posterior ventral margin and quite thin and fragile toward the shell's posterior margin. The nacre is whitish to bluish white in color. Shells are somewhat solid. Umbos are moderately full, slightly anterior, and elevated above hinge line. The cardinal teeth are small and serrated; lateral teeth are short and straight. Length 2-2.5 inches.

## Habitat Description

This species inhabits **small to medium-sized rivers, and sometimes large rivers**, in areas with coarse sand to boulder substrate (rarely in mud) and moderate to swift currents. It is sometimes found associated with water-willow (*Justicia americana)* beds and in pockets of gravel between bedrock ledges in areas of swift current.

## Critical Habitat

Yes (*See additional maps and detailed descriptions provided after the decision key)*

Critical habitat for the oyster mussel was designated on August 31, 2004.

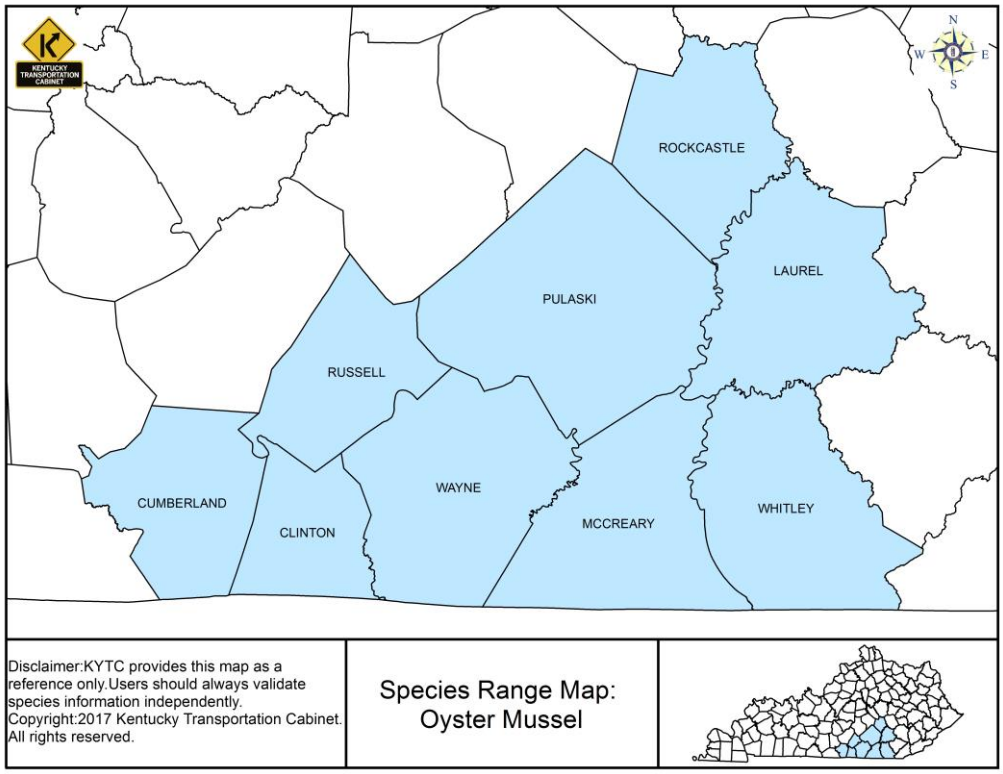
Primary constituent elements of critical habitat for this species include:

1. Permanent, flowing stream reaches with a flow regime (*i.e*, the magnitude, frequency, duration, and seasonality of discharge over time) necessary for normal behavior, growth, and survival of all life stages of the five mussels and their host fish.
2. Geomorphically stable stream and river channels and banks (structurally stable stream cross section).
3. Stable substrates, consisting of mud, sand, gravel, and/or cobble/ boulder, with low amounts of fine sediments or attached filamentous algae.
4. Water quality (including temperature, turbidity, oxygen content, and other characteristics) necessary for the normal behavior, growth, and survival of all life stages of the mussels and their host fish.
5. Fish hosts with adequate living, foraging, and spawning areas.

| Species, Stream (unit), and State | Currently Occupied River Miles | Currently Unoccupied River Miles |
|---|---|---|
| **Oyster Mussel** | | |
| Duck River (Unit 1), TN | 46 | ..... |
| Bear Creek (Unit 2), AL, MS | ..... | 25 |
| Powell River (Unit 4), TN, VA | ..... | 94 |
| Clinch River (Unit 5), TN, VA | 150 | ..... |
| Copper Creek (Unit 5), VA | ..... | 13 |
| Nolichucky River (Unit 6), TN | 5 | .... |
| Big South Fork (Unit 9), Tn, KY | ..... | 27 |
| Buck Creek (Unit 10), KY | ..... | 36 |

## Range

The oyster mussel's range historically included four physiographic provinces (Interior Low Plateau, Cumberland Plateau, Ridge and Valley, Blue Ridge) and six States (Alabama, Georgia, Kentucky, North Carolina, Tennessee, and Virginia). In the Cumberland River it occurred from the base of Cumberland Falls, McCreary and Whitley Counties, Kentucky, downstream to Stewart County, Tennessee. Non-essential, experimental populations have been established in the Tennessee River in Alabama, and in portions of the Holston and French Broad Rivers in Tennessee.



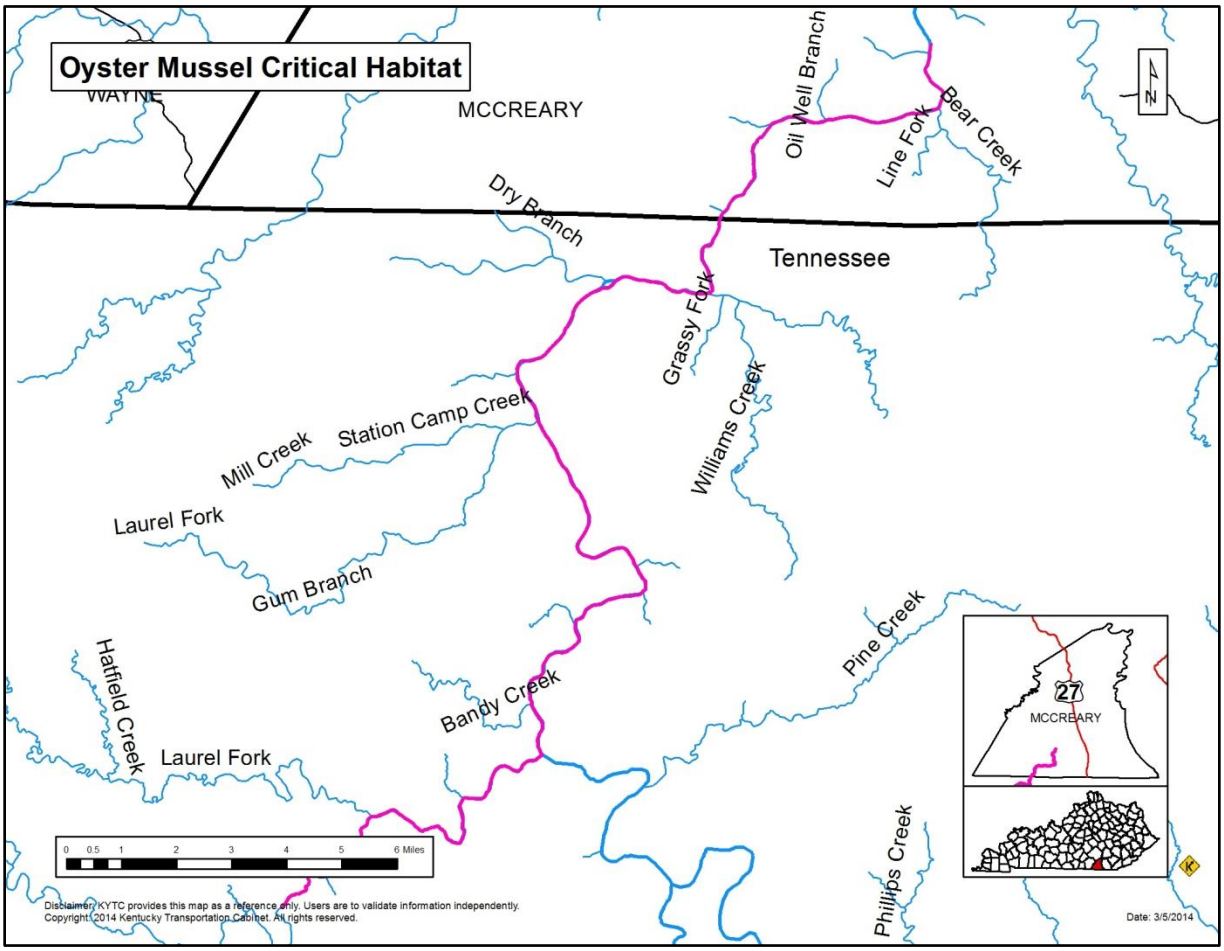

## Decision Key

1) Does the project include any direct or indirect effects to **perennial streams or their nearby tributaries**? (e.g. – remove riparian vegetation, alter stream banks, change water levels/flow, dredge, construct/remove bridge piers, etc.)

    a. Yes: Contact SME
    b. No: Prepare NE finding

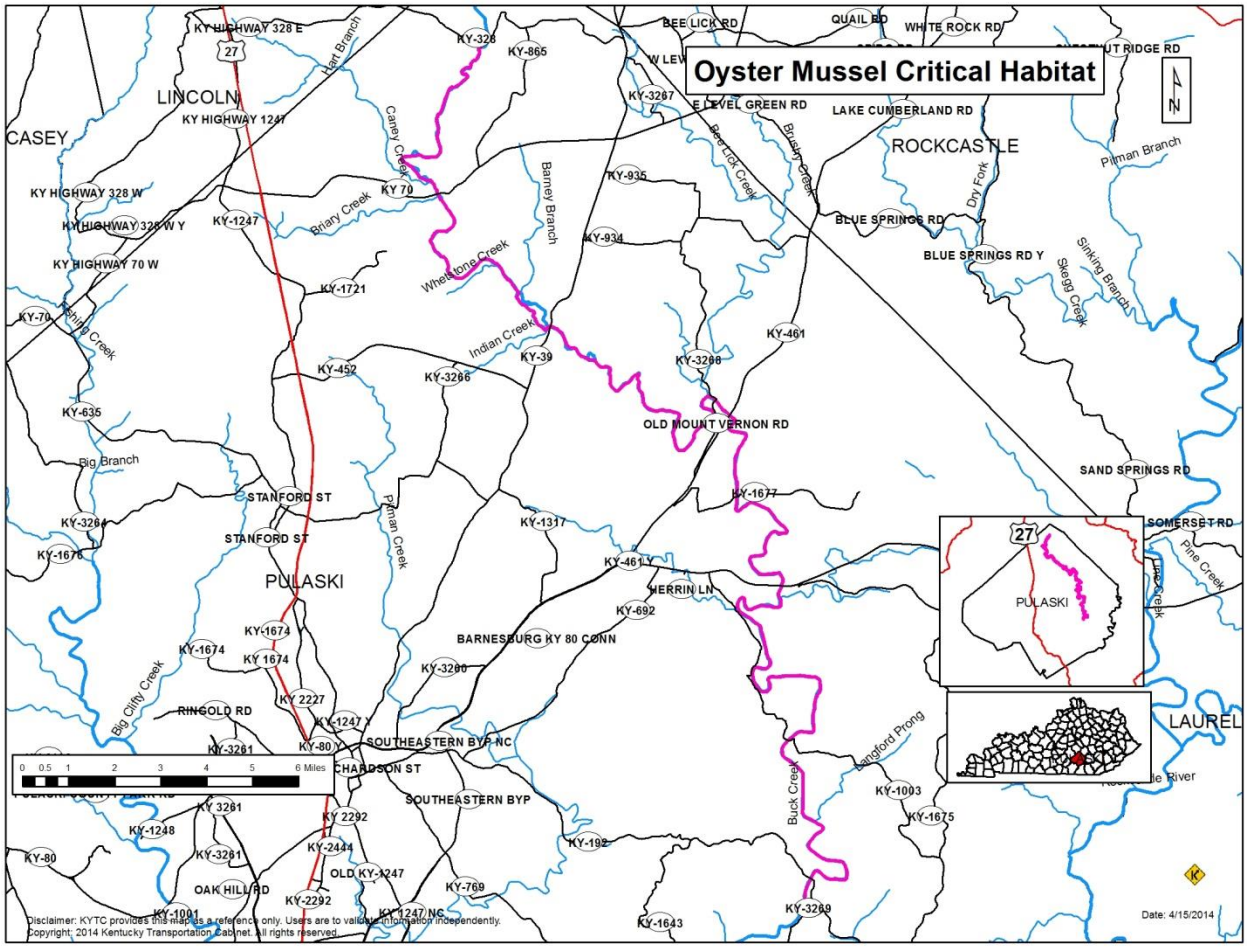
***Unit 9. Big South Fork and Tributaries, Fentress, Morgan, and Scott Counties, Tennessee, and McCreary County, Kentucky.***

Unit 9 encompasses 153 rkm (95 rmi) and consists of 43 rkm (27 rmi) of the Big South Fork of the Cumberland River main stem from its confluence with Laurel Crossing Branch downstream of Big Shoals, McCreary County, Kentucky, upstream to its confluence with the New River and Clear Fork, Scott County, Tennessee; 11 rkm (7 rmi) of North White Oak Creek from its confluence with the Big South Fork upstream to Panther Branch, Fentress County, Tennessee; 14.5 rkm (9.0 rmi) of the New River from its confluence with Clear Fork upstream to U.S. Highway 27, Scott County, Tennessee; 40 rkm (25 rmi) of Clear Fork from its confluence with the New River upstream to its confluence with North Prong Clear Fork, Morgan and Fentress Counties, Tennessee; 10 rkm (6 rmi) of White Oak Creek from its confluence with Clear Fork upstream to its confluence with Bone Camp Creek, Morgan County, Tennessee; 6 rkm (4 rmi) of Bone Camp Creek from its confluence with White Oak Creek upstream to Massengale Branch, Morgan County, Tennessee; 14.5 rkm (9.0 rmi) of Crooked Creek from its confluence with Clear Fork upstream to Buttermilk Branch, Fentress County, Tennessee; and 14.5 rkm (9 rmi) of North Prong Clear Fork from its confluence with Clear Fork upstream to Shoal Creek, Fentress County, Tennessee.



***Unit 10. Buck Creek, Pulaski County, Kentucky.***

Unit 10 encompasses 58 rkm (36 rmi) and includes Buck Creek from the State Route 192 Bridge upstream to the State Route 328 Bridge in Pulaski County, Kentucky.



# Pink Mucket (*Lampsilis abrupta*)

## Species Description

The pink mucket was listed as **endangered** on June 14, 1976.

Photo Credit:
http://wwx.inhs.illinois.edu/collections/mollusk/publications/guide/index/154

The pink mucked has a thick heavy shell with inflated valves that gape on the anterior-ventral edge. Shell shape is elliptical, subovate, and subquadrate. The periostracum typically has no sculpture and color ranges from pale yellow to deep brown. The species is sexually dimorphic with females being more broadly rounded to quadrate at the posterior end. Umbo is nearly even with the hinge line, and is on the anterior third of the shell. In young individuals, umbos are marked by faint, scarcely looped ridges. Cardinal teeth are large and serrated; lateral teeth are heavy and short.
Length 4-5 inches.

## Habitat Description

This species prefers sandy mud and gravel substrates of **medium to large river systems**, in moderate to fast flowing water. The species is most often collected in depths ranging from 1 to 26 ft. However, the species appears to have adapted to deeper water conditions found in the impounded Tennessee and Cumberland rivers where dam releases apparently offer suitable conditions for propagation.

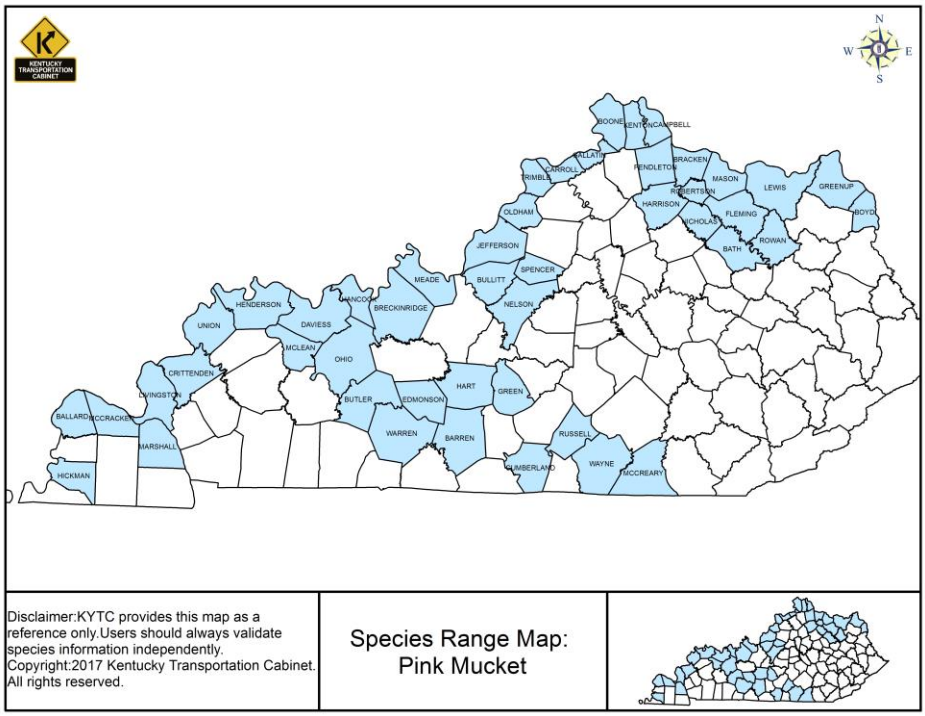
## Critical Habitat

None

## Range

Historical records for the pink mucket include the Tennessee, Cumberland, and Ohio River drainages with occasional records from the Mississippi River drainage. Watters et al. (2009) describes the range to include the lower Mississippi River system north to the Ohio River, including the Green River of Kentucky, Kanawha River of West Virginia, the upper Tennessee and Cumberland rivers, Meramec and Missouri rivers of Missouri, and the White and Red rivers of Arkansas.

In Kentucky specifically, associated rivers systems of the pink mucket include the Ohio, Green, Cumberland, Licking, Salt, and Tennessee. The pink mucket is a mussel that has always been considered rare, but it seems to be holding its own or increasing, even in some impounded rivers. For this mussel, conservation concern has been assigned not because of current imperilment, but because of the potential for it to become imperiled in the future.




## Decision Key

1) Does the project include any direct or indirect effects to any **medium to large rivers or their nearby tributaries**? (e.g. – remove riparian vegetation, alter stream banks, change water levels/flow, dredge, construct/remove bridge piers, etc.)

    a. Yes: Contact SME
    b. No: Prepare NE finding

# Purple Catspaw Pearlymussel (*Epioblasma obliquata)*

AKA: *Epioblasma obliquata obliquata*

## Species Description

The purple catspaw pearlymussel was listed as **endangered** in 1990.

Photo Credit:
http://wwx.inhs.illinois.edu/collections/mollusk/publications/guide/index/154

The mussel's shell is elongate oval to rectangular, inflated, solid and thick. Females are dimorphic from males and are more squared with a protrusion on the posterior margin. Umbo is anterior and above hinge line. Shell is smooth, tan or brown, with fine green rays. Cardinal teeth are large and serrated; lateral teeth thick and short. Length 2.5 – 3 inches.

## Habitat Description

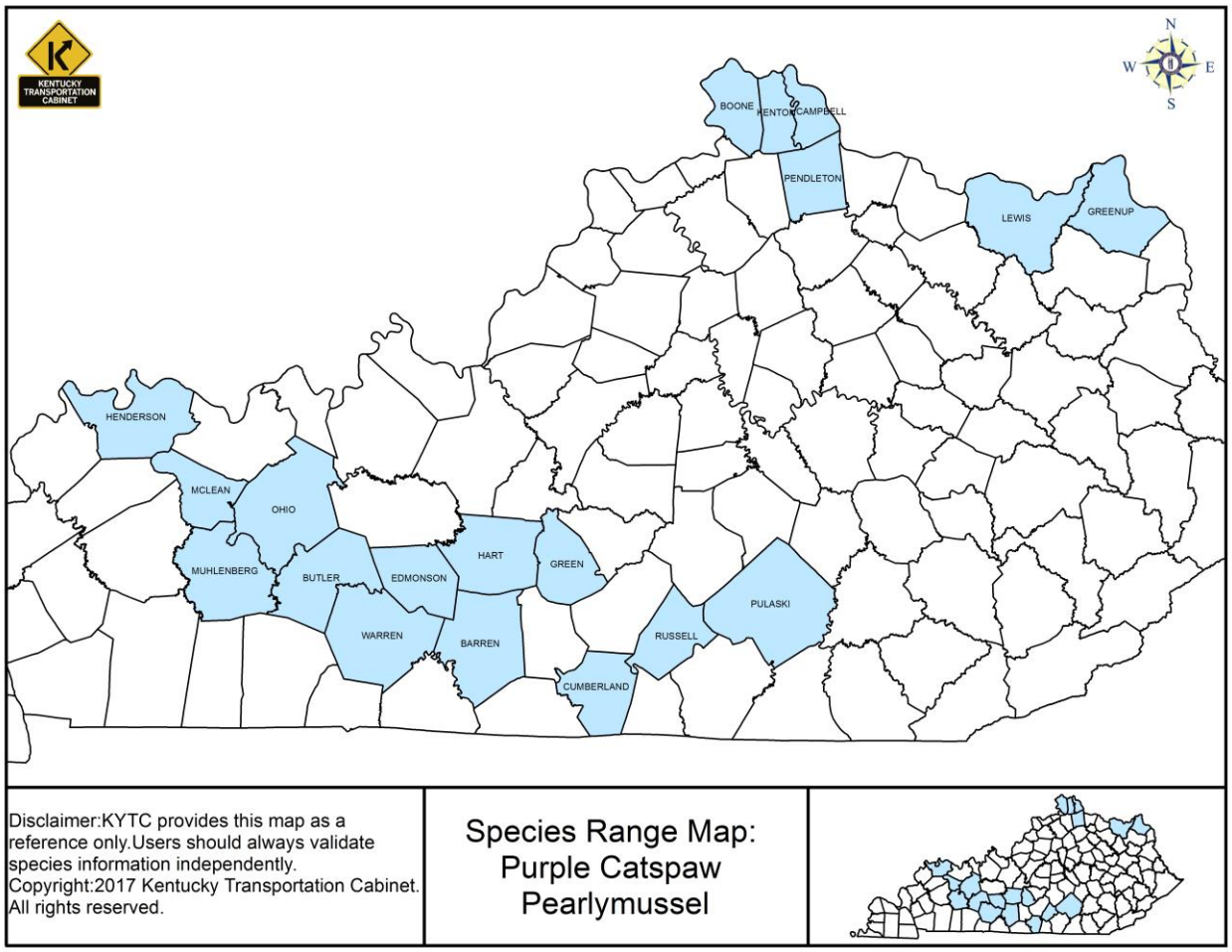
The habitat for this mussel is usually defined as **medium to large rivers** in sand and gravel, and this is the most likely habitat for this species. However, a population exists in a **small stream** (Killbuck Creek) in Ohio. In this small stream habitat, it is found in riffle and run habitats with sand, gravel, and cobble substrates in fairly fast flowing to almost still water. These mussels live completely buried in the substrate, although females will move to the surface when they are ready to release their glochidia. These females are generally found along the margin of the stream in fairly shallow water.

## Critical Habitat

None

## Range

The purple catspaw pearlymussel ranges from parts of the Cumberland River, Ohio River, and Green River systems. The type specimen is from the Kentucky River, but it is considered extirpated from that river system. A non-essential, experimental population has been established in the Tennessee River in Alabama.




## Decision Key

1) Does the project include any direct or indirect effects to **perennial streams or their nearby tributaries**? (e.g. – remove riparian vegetation, alter stream banks, change water levels/flow, dredge, construct/remove bridge piers, etc.)

    a. Yes: Contact SME
    b. No: Prepare NE finding

# Rabbitsfoot Mussel (*Theliderma cylindrica*)

AKA: *Quadrula cylindrica cylindrica*

## Species Description

Photo Credit:
http://wwx.inhs.illinois.edu/collections/mollusk/publications/guide/index/32

The rabbitsfoot mussel was listed as **threatened** on September 17, 2013.

The umbo is moderately elevated and raised only slightly above the hinge line. Beak sculpture consists of a few strong ridges or folds continuing onto the newer growth of the umbo as small tubercles. Shell sculpture consists of a few large, rounded, low tubercles on the posterior slope, although some individuals will have numerous small, elongated pustules particularly on the anterior.

The periostracum is generally smooth and yellowish, greenish, or olive in color becoming darker and yellowish-brown with age and usually covered with dark green or nearly black chevrons and triangles pointed ventrally. These patterns are absent in some individuals. Internally, the color of the nacre is white and iridescent, often with a grayish-green tinge in the umbo cavity. Specimens from the southern periphery of its range are occasionally purplish. Soft parts generally have an orange coloration. Cardinal teeth are large and serrated; lateral teeth are long and straight. Length 4-5 inches.

## Habitat Description

Rabbitsfoot is primarily an inhabitant of **small to medium-sized streams and some larger rivers**. It usually occurs in shallow water areas along the bank and adjacent runs and shoals with reduced water velocity. Specimens also may occupy deep water runs, having been reported in 9 to 12 feet of water. Bottom substrates generally include gravel and sand. This species seldom burrows but instead lies on its side.

## Critical Habitat

Yes

Critical habitat for the rabbitsfoot was designated on August 27, 2013.

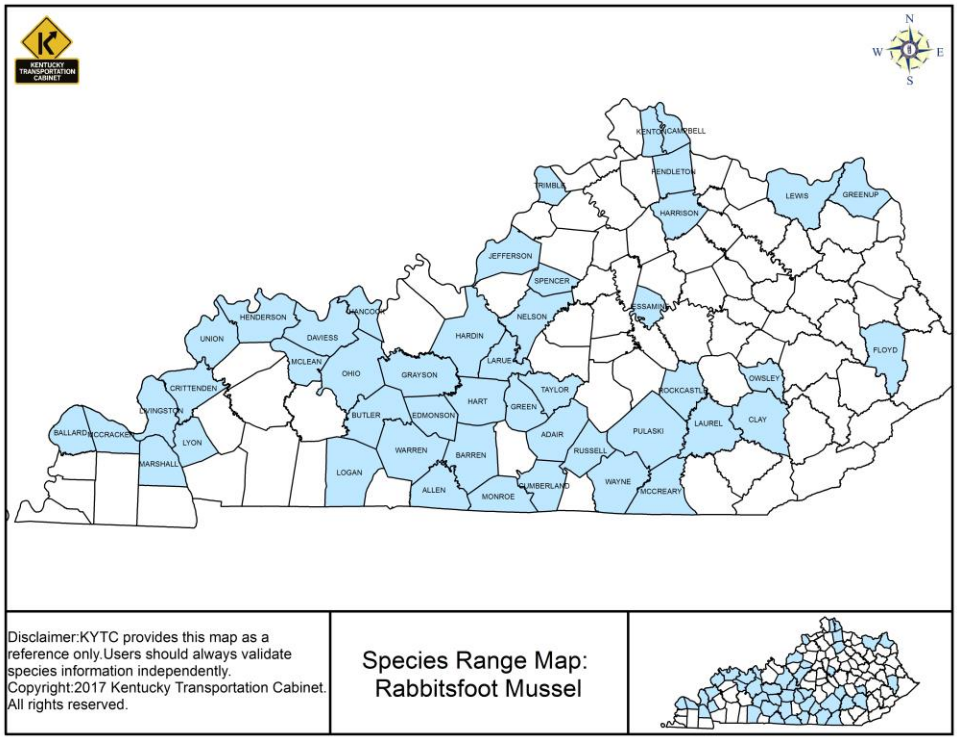
Primary constituent elements of critical habitat for this species are:

1. Geomorphically stable river channels and banks (channels that maintain lateral dimensions, longitudinal profiles, and sinuosity patterns over time without an aggrading or degrading bed elevation) with habitats that support a diversity of freshwater mussel and native fish (such as, stable riffles, sometimes with runs, and mid-channel island habitats that provide flow refuges consisting of gravel and sand substrates with low to moderate amounts of fine sediment and attached filamentous algae).
2. A hydrologic flow regime (the severity, frequency, duration, and seasonality of discharge over time) necessary to maintain benthic habitats where the species are found and to maintain connectivity of rivers with the floodplain, allowing the exchange of nutrients and sediment for maintenance of the mussel's and fish host's habitat, food availability, spawning habitat for native fishes, and the ability for newly transformed juveniles to settle and become established in their habitats.
3. Water and sediment quality (including, but not limited to, conductivity, hardness, turbidity, temperature, pH, ammonia, heavy metals, and chemical constituents) necessary to sustain natural physiological processes for normal behavior, growth, and viability of all life stages.
4. The presence and abundance (currently unknown) of fish hosts necessary for recruitment of the rabbitsfoot. The occurrence of natural fish assemblages, reflected by fish species richness, relative abundance, and community composition, for each inhabited river or creek will serve as an indication of appropriate presence and abundance of fish hosts until appropriate host fish can be identified.
5. Either no competitive or predaceous invasive (nonnative) species, or such species in quantities low enough to have minimal effect on survival of freshwater mussels.

| Species, Stream (unit), and State | Currently Occupied River Miles | Currently Unoccupied River Miles |
|---|---|---|
| **Rabbitsfoot Mussel** | | |
| *Units RF1 - RF20a are not in KY | | |
| Tennessee River (RF20b), KY | 22.1 | ..... |
| Ohio River (RF21), KY, IL | 28.5 | ..... |
| Green River (RF22), KY | 109.1 | ..... |
| *Units RF23 - RF30 are not in KY | | |
| Red River (RF31), KY, TN | 31.2 | ..... |
| *Remaining units are not in KY | | |

## Range

The Rabbitsfoot historically occurred in 140 streams within the lower Great Lakes Sub-basin and Mississippi River Basin. The historical range included Alabama, Arkansas, Georgia, Illinois, Indiana, Kansas, Kentucky, Louisiana, Mississippi, Missouri, Ohio, Oklahoma, Pennsylvania, Tennessee, and West Virginia. Rabbitsfoot populations are considered to be extant in 51 streams in 13 states, representing a 64 percent decline (51 extant streams of 140 historical populations). In streams where it remains extant, populations are highly fragmented and restricted to short reaches. Based upon existing habitat use (need for flowing vs. impounded habitats) and fish host (small minnow species with limited individual ranges) data, it is unlikely that recruitment between populations or establishment of new populations could occur naturally.

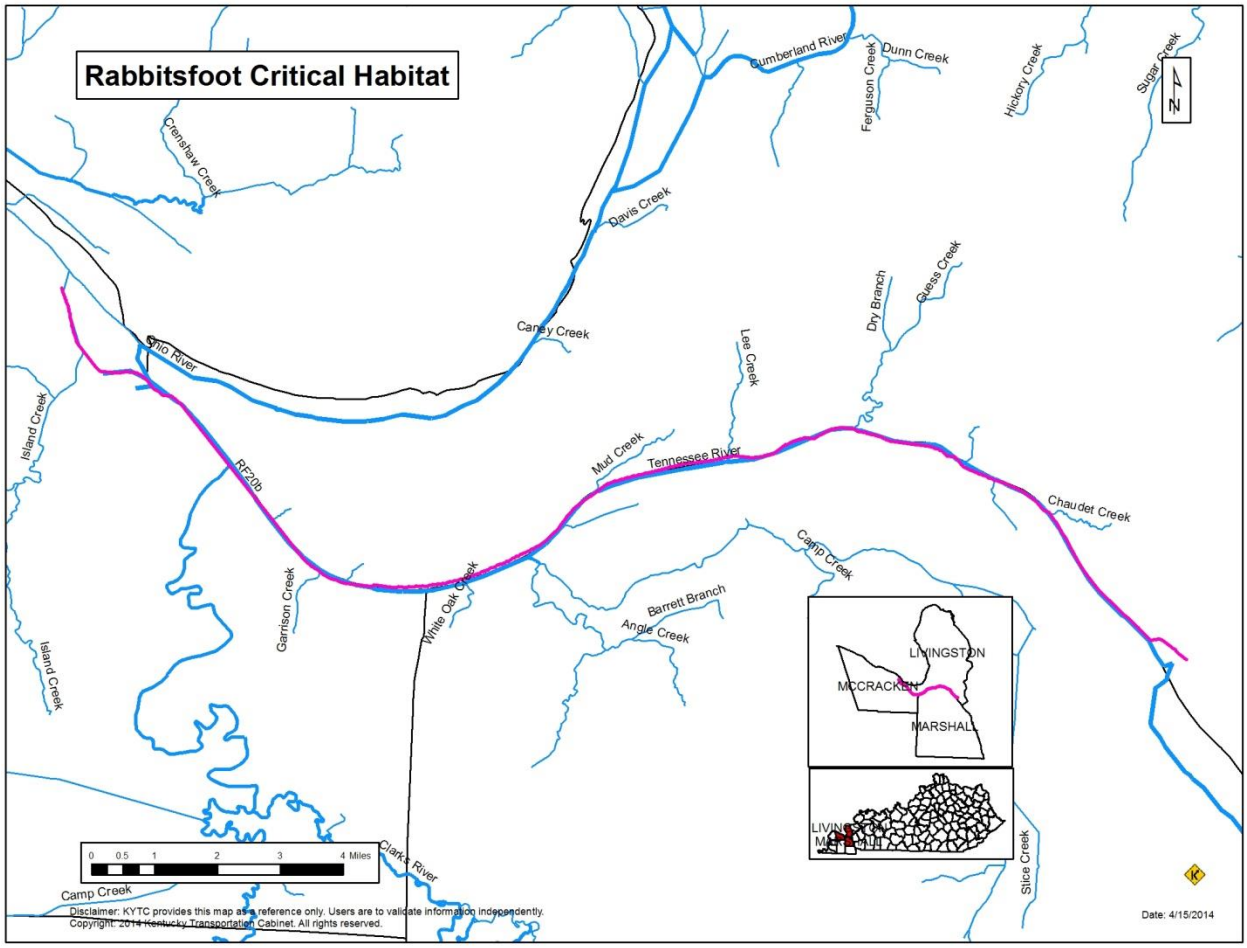



## Decision Key

1) Does the project include any direct or indirect effects to **perennial streams or their nearby tributaries**? (e.g. – remove riparian vegetation, alter stream banks, change water levels/flow, dredge, construct/remove bridge piers, etc.)

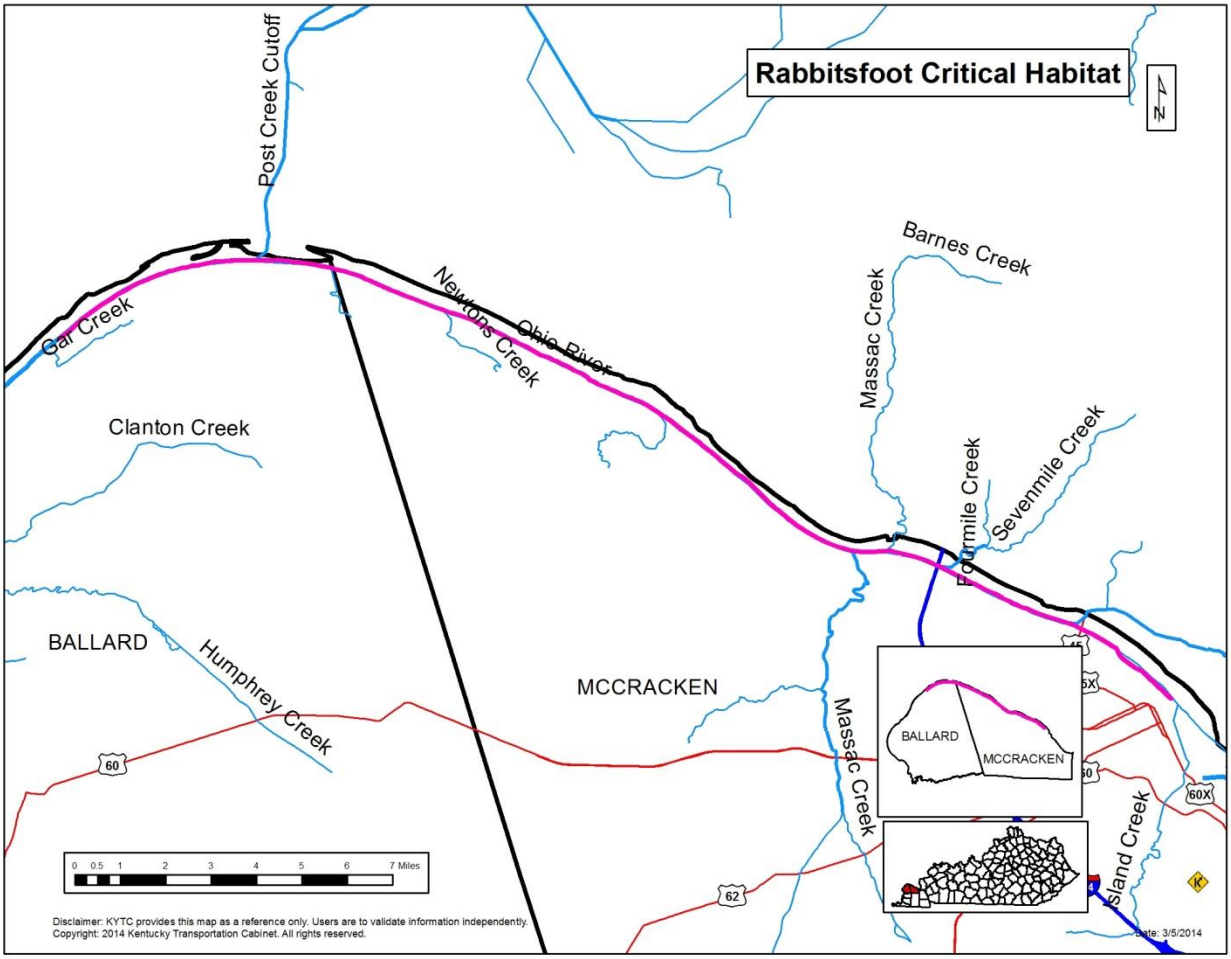
    a. Yes: Contact SME
    b. No: Prepare NE finding

***Unit RF20b: Tennessee River— Livingston, Marshall, and McCracken Counties,*** *Kentucky*
Unit RF20b includes 35.6 rkm (22.1 rmi) of Tennessee River from Kentucky Lake Dam downstream to its confluence with the Ohio River, McCracken and Livingston Counties, Kentucky.



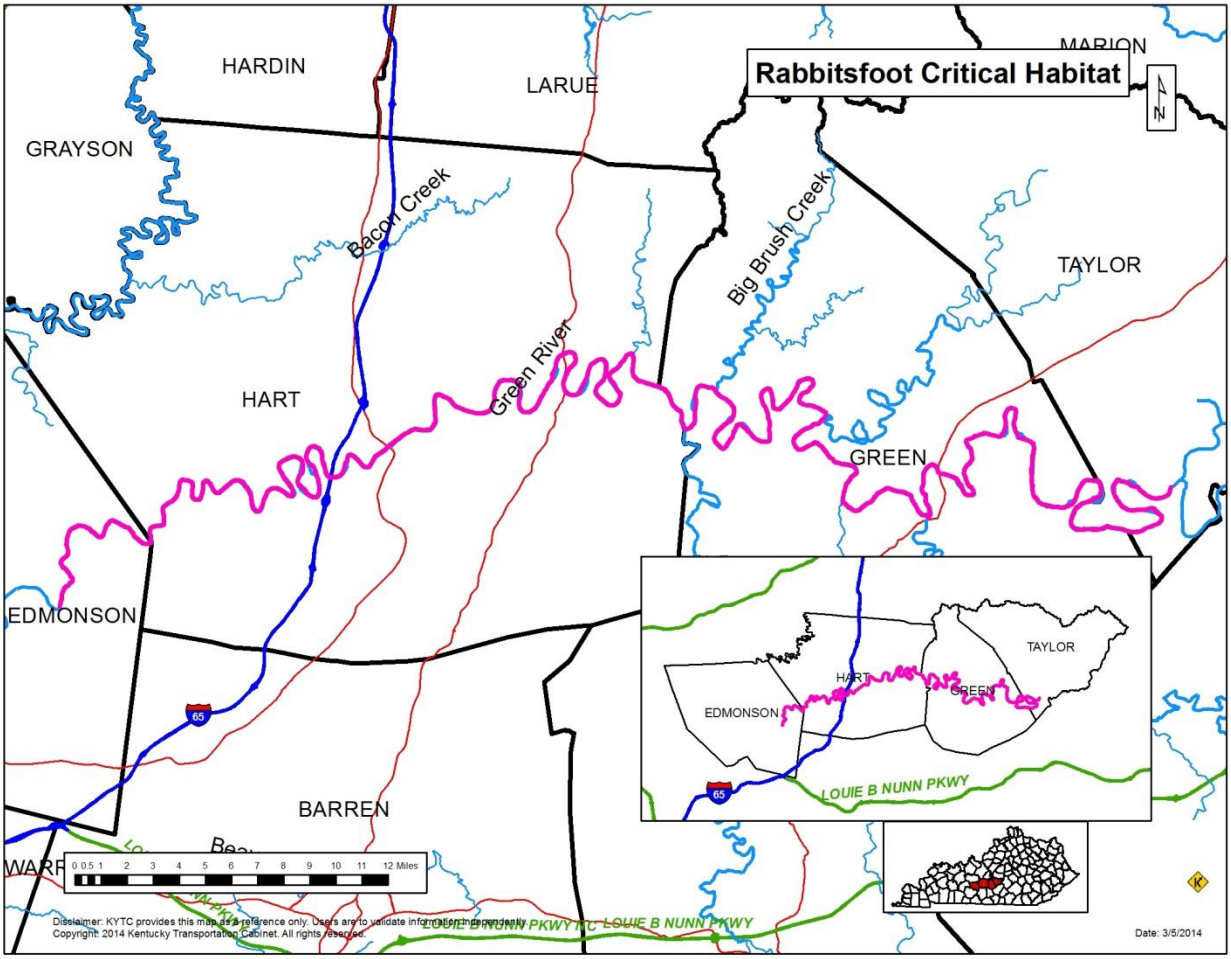
***Unit RF21: Ohio River—Ballard, Livingston, and McCracken Counties, Kentucky; Massac and Pulaski Counties, Illinois***

Unit RF21 includes 45.9 rkm (28.5 rmi) of the Ohio River from the Tennessee River confluence downstream to Lock and Dam 53 near Olmstead, Illinois.

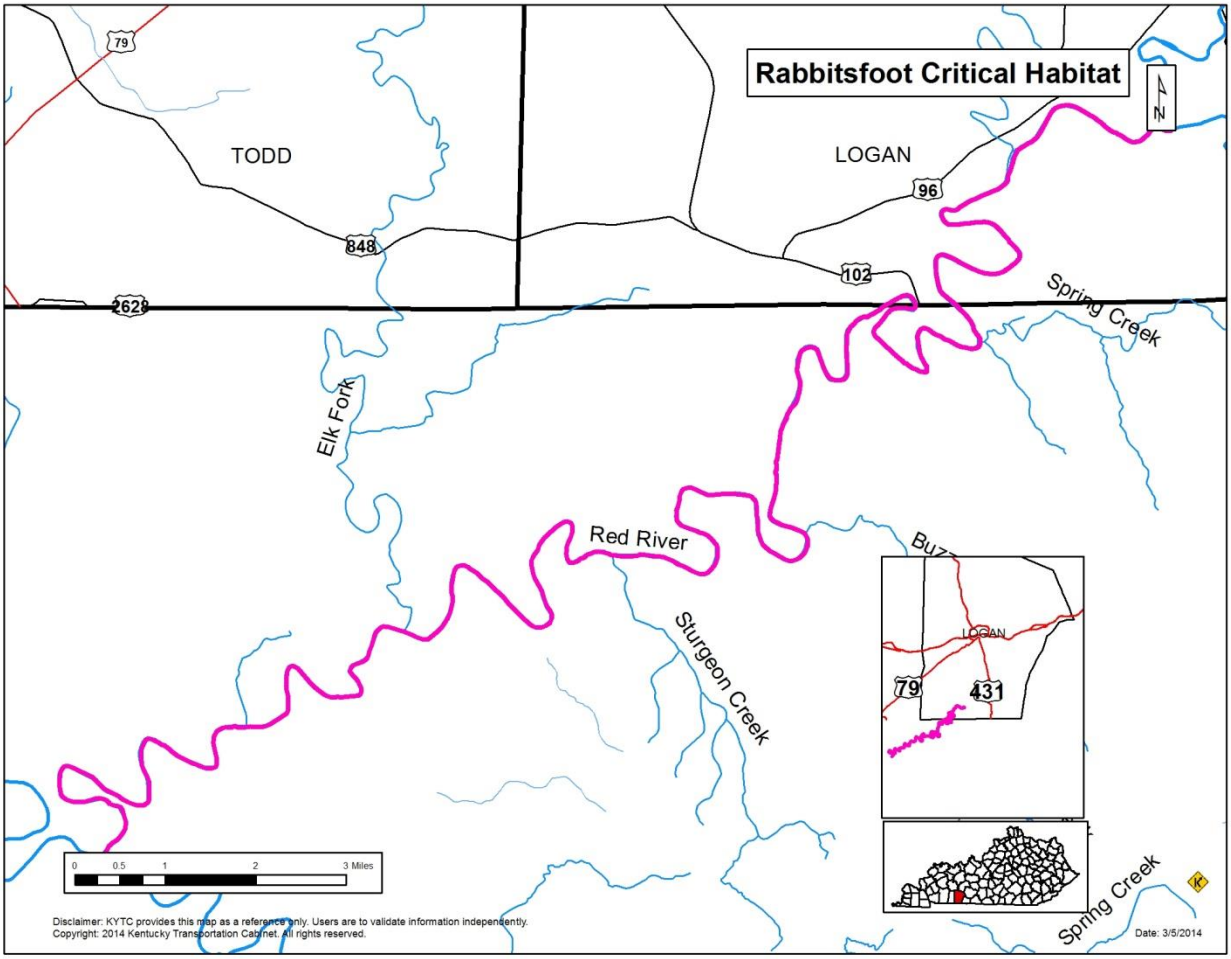


***Unit RF22: Green River—Green, Hart, and Taylor Counties, Kentucky***

Unit RF22 includes 175.6 rkm (109.1 rmi) of the Green River from Green River Lake Dam south of Campbellsville, Taylor County, Kentucky, downstream to Maple Springs Ranger Station Road in Mammoth Cave National Park, Kentucky.



***Unit RF31: Red River—Logan County, Kentucky; and Robertson County, Tennessee***
Unit RF31 includes 50.2 rkm (31.2 rmi) of the Red River from the South Fork Red River confluence west of Adairville, Kentucky, downstream to the Sulphur Fork confluence southwest of Adams, Tennessee.



# Rayed Bean Mussel (*Villosa fabalis*)

## Species Description

The rayed bean was listed as **endangered** on February 14, 2012.

Photo Credit:
http://wwx.inhs.illinois.edu/collections/mollusk/publications/guide/index/142

The rayed bean is an elongate oval, moderately inflated, and thick shelled. Males are posteriorly more pointed than females. Females have a slightly more rounded posterior margin. The shell is yellow, tan, or green colored with numerous dark green rays. These rays may nearly cover the entire shell and persist throughout mussel's life time. Umbos are low, but extend above the hinge line. Cardinal teeth are small; lateral teeth are thick and short. Length 1-2 inches.

## Habitat Description

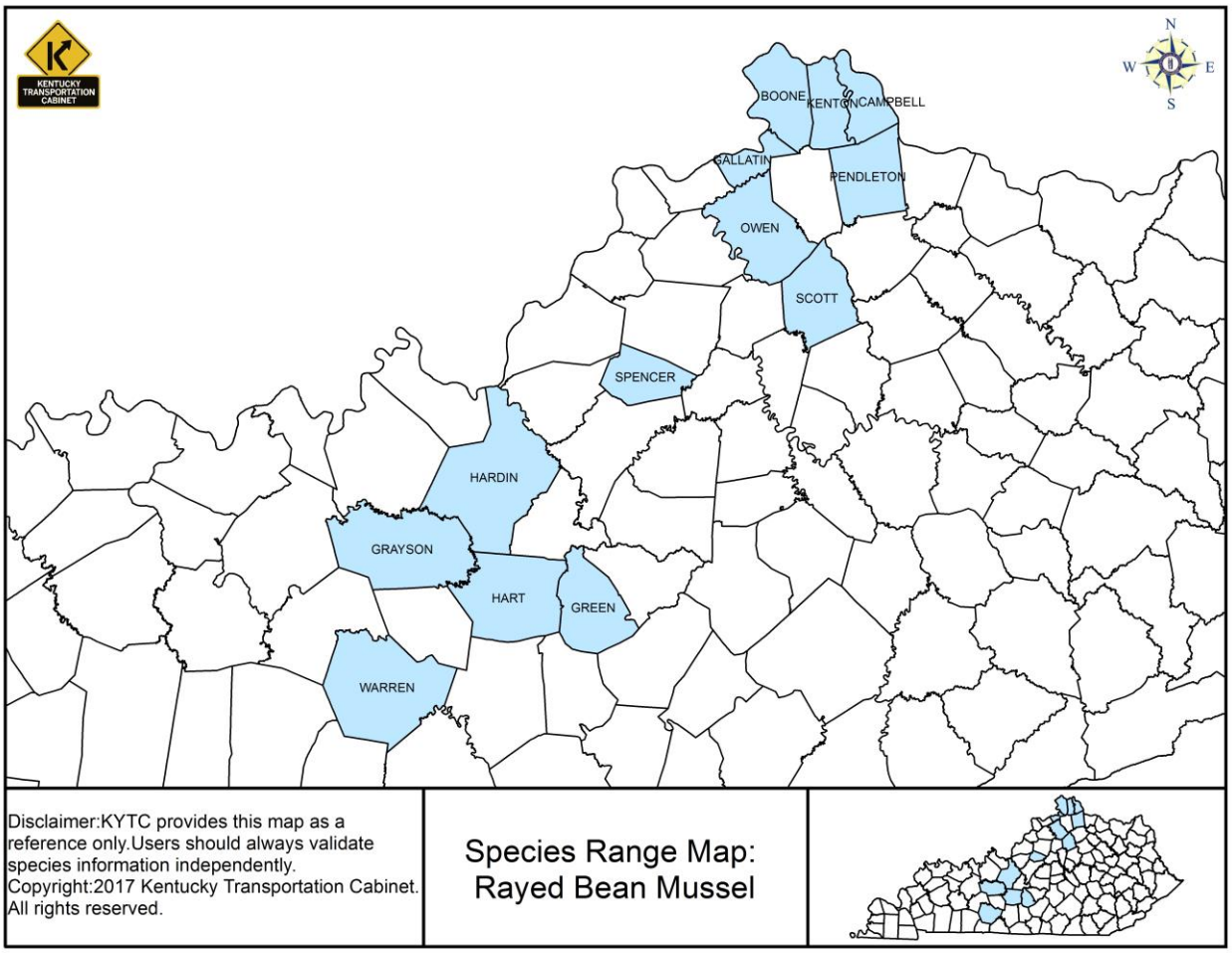
The rayed bean lives in sand and cobble in high quality **medium streams and small rivers**, although sparse records indicate that this mussel is difficult to find during surveys and that it may exist in a wider range of stream sizes. They can often be found near riffles, generally in water weeds, and deeply buried in sand and gravel bound together by roots.

## Critical Habitat

None

## Range

This species is perhaps more widely distributed than its current known range would suggest. It is a small, secretive species that is difficult to detect and locate. The rayed bean is widely, but sporadically distributed. In Kentucky, this species is associated with the Green, Ohio, Licking, Salt, Barren, and Kentucky River systems.




## Decision Key

1) Does the project include any direct or indirect effects to **perennial streams or their nearby tributaries**? (e.g. – remove riparian vegetation, alter stream banks, change water levels/flow, dredge, construct/remove bridge piers, etc.)

    a. Yes: Contact SME
    b. No: Prepare NE finding

# Ring Pink (*Obovaria retusa*)

## Species Description

The ring pink was listed as **endangered** on September 29, 1989.

The vertically elongated shell, prominent umbo, and purple nacre are unique to this species. Valves for this shell are thick and heavy. Sexual dimorphism is often present with females having a truncated posterior margin. Periostracum is yellowish-tan to brown, and darkens with age. It can be rayless or have vague green rays. Cardinal teeth are large and serrated; lateral teeth thick and short. Length 2-3 inches.

Photo Credit:
http://wwx.inhs.illinois.edu/collections/mollusk/publications/guide/index/112

## Habitat Description

Known as a **medium to large river** species, the ring pink has been found in gravel and sandy substrates in relatively shallow waters (2 feet); typically inhabiting gravel bars of rivers.

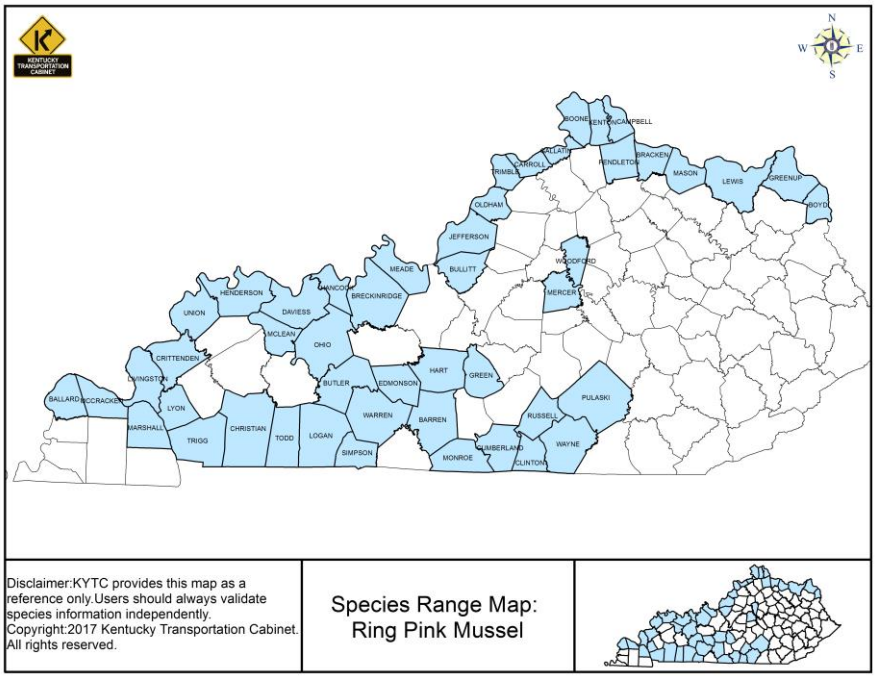
## Critical Habitat

None

## Range

The historic distribution likely included the Ohio River and its larger tributaries in Alabama, Illinois, Indiana, Kentucky, Ohio, Pennsylvania, Tennessee, and West Virginia. The species is presently known from five relicts, possibly non-reproducing populations in the Tennessee River (one population each in KY and TN), Green (KY), Cumberland (TN), and Kanawha rivers (WV). It is possible that the only viable population remaining is found in the Green River, Kentucky.

In Kentucky specifically, the ring pink is associated with the Ohio, Green, Kentucky, Barren, Cumberland, and Tennessee River systems. The ring pink apparently has the ability to persist at extremely low population densities. As an example of this persistence at low population densities, the ring pink is known to occur in the Green and Tennessee Rivers in Kentucky, but only single individuals have been found about every 10 years since the 1960's. A non-essential, experimental population has been established in portions of the Holston and French Broad Rivers in Tennessee.




## Decision Key

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    a. Yes: Contact SME
    b. No: Prepare NE finding

# Rough Pigtoe Mussel (*Pleurobema plenum*)

## Species Description

The rough pigtoe was listed as **endangered** in 1976.

The rough pigtoe's shell is triangular, inflated, and thick. Anterior margin is rounded, while the posterior margin is rounded or bluntly pointed. Ventral margin is curved. Umbo is inflated and extends above hinge line. The shell is relatively smooth with a weak sulcus (sometimes). The shell is light to dark brown, sometimes with faint rays. Nacre is white. Cardinal teeth are large and serrated' lateral teeth are thick and short. Length 3-4 inches.

Photo Credit:
http://wwx.inhs.illinois.edu/collections/mollusk/publications/guide/index/60

## Habitat Description

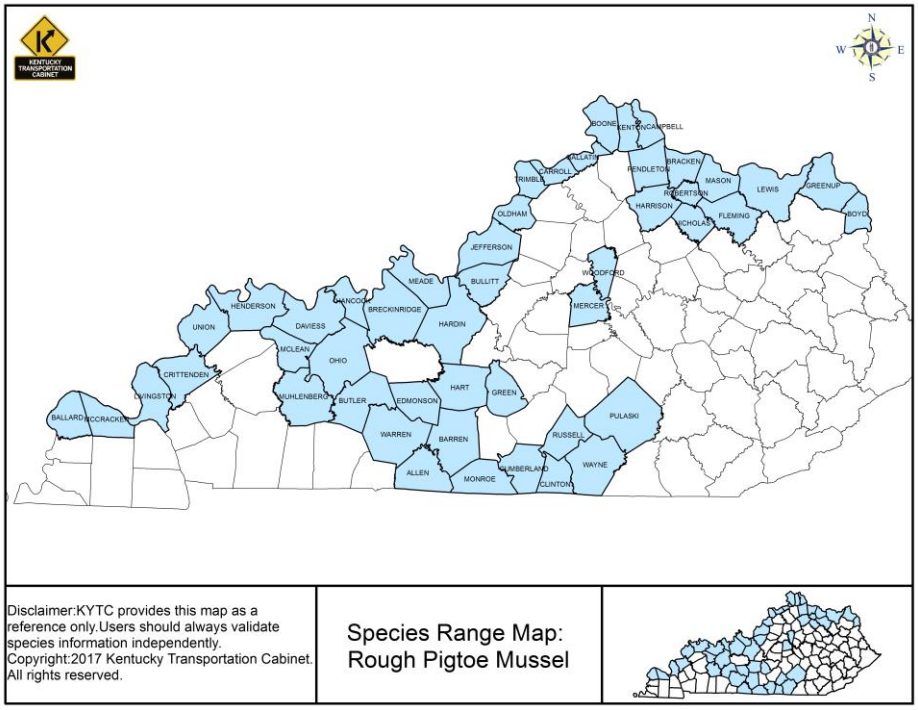
Although the rough pigtoe may become established in small rivers or headwater stretches of rivers, it is a species most typical of large rivers. It occurs in a stable substrate consisting of muddy to coarse sand, cobble, and gravel.

## Critical Habitat

None

## Range

Historically, the rough pigtoe had a widespread distribution in eastern North America which included the Ohio, Tennessee, and Cumberland Rivers systems (including their tributaries). This range, however, is problematic. The rough pigtoe belongs to what is considered the "*Pleurobema* complex" of mussels, wherein four species (*P. plenum, P. rubrum, P. cordatum, and P. sintoxia*) all look so similar that some historic specimens have undoubtedly been misinterpreted. Despite sometimes unclear morphologic divisions between these mussels, the rough pigtoe is still considered to potentially be in the Ohio, Licking, Kentucky, Cumberland, Green, and Barren River systems. Non-essential, experimental populations have been established in the French Broad and Holston Rivers in Tennessee.




## Decision Key

1) Does the project include any direct or indirect effects to **perennial streams or their nearby tributaries**? (e.g. – remove riparian vegetation, alter stream banks, change water levels/flow, dredge, construct/remove bridge piers, etc.)

    a. Yes: Contact SME
    b. No: Prepare NE finding

# Scaleshell (*Leptodea leptodon*)

## Species Description

The scaleshell mussel was listed as **endangered** on October 9, 2011.

Photo Credit:
http://wwx.inhs.illinois.edu/collections/mollusk/publications/guide/index/118

The periostracum is smooth, yellowish green or brown, with numerous faint green rays. The shells are elongate, very thin, compressed, and rhomboidal. The anterior end is rounded. The dorsal margin is straight, and the ventral margin is gently rounded. Umbos are small and low, and nearly even with the hinge line. The umbo sculpture, which may not be visible in older individuals, is inconspicuously compressed and consists of four or five double-looped ridges. The pseudocardinal teeth are reduced to a small, thickened ridge. The lateral teeth are moderately long with two indistinct teeth occurring in the left valve and one fine tooth in the right valve. The nacre is pinkish white or light purple and highly iridescent. Length 4-5 inches.

## Habitat Description

The scaleshell occurs in **medium to large rivers** with low to medium gradients. It inhabits a variety of substrate types, but is primarily found in stable riffles and runs with slow to moderate current velocity. It is also usually found in stable channels where a diversity of other mussel species are concentrated (i.e. mussel bed). This is typical for several other mussel species as suitable stream habitat for freshwater mussels naturally occurs in relatively small patches separated by longer reaches of unsuitable habitat.

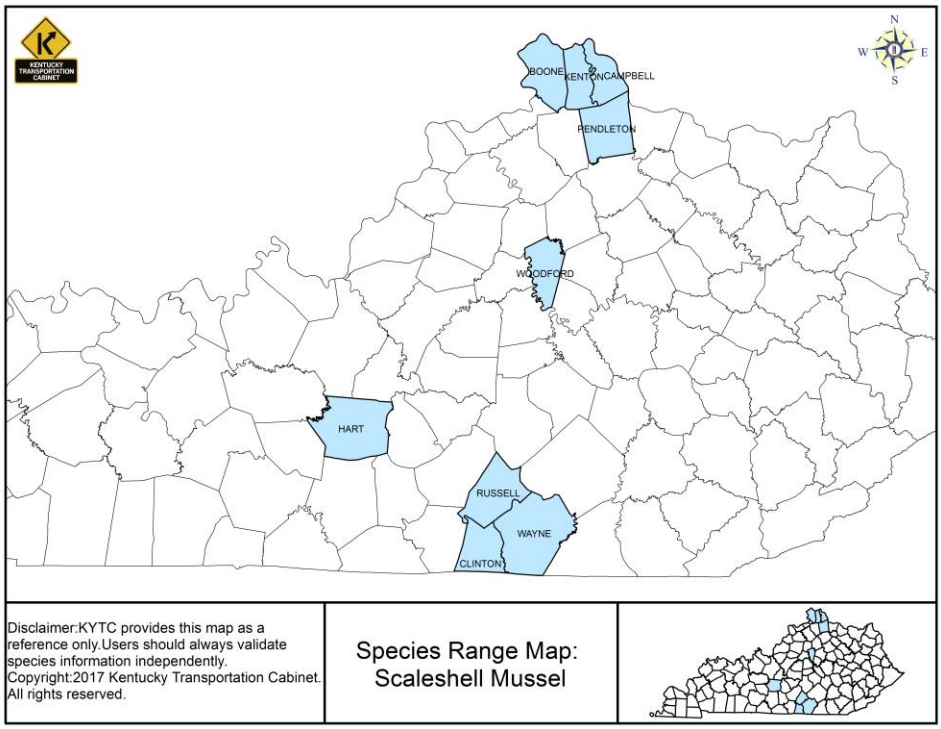
The habitat observations discussed above are consistent with the current distribution of the scaleshell; the species is restricted to streams that have maintained relatively good water quality and to stream reaches with stable channels. However, more specific physical, chemical, and biological habitat requirements of the scaleshell are unknown, particularly of the juvenile stage.

## Critical Habitat

None

## Range

The species once occurred in 56 rivers in the Mississippi River drainage. The species has undergone a dramatic reduction in range and is believed to be extirpated from 9 of the 13 states where it historically occurred. While the species has been documented from 18 streams in the last 25 years, it can only be found consistently in three streams in Missouri where it is still very rare. In Kentucky, the scaleshell can be considered to potentially occur in stretches of the Licking, Ohio, Green, Kentucky, and Cumberland River systems.




## Decision Key

1) Does the project include any direct or indirect effects to any **medium to large rivers or their nearby tributaries**? (e.g. – remove riparian vegetation, alter stream banks, change water levels/flow, dredge, construct/remove bridge piers, etc.)

    a. Yes: Contact SME
    b. No: Prepare NE finding

# Sheepnose Mussel (*Plethobasus cyphyus*)

## Species Description

The sheepnose mussel was listed as **endangered** in 2012.

Photo Credit:
http://www.museum.state.il.us/ismdepts/zoology/mussels/gallery.html

The shell of the sheepnose is thick, moderately inflated, and forms an elongate oval in profile. The posterior margin forms a blunt point or is squared while the anterior margin is rounded. The posterior ridge is rounded, anterior of which is a faint sulcus. Faint sculpture, in the form of low knobs, runs from the umbo to the ventral margin. The periostracum is yellow to brown. Umbos are wide and prominent. Cardinal teeth are moderately large and serrated; lateral teeth are thick and long. Length 4-5 inches.

## Habitat Description

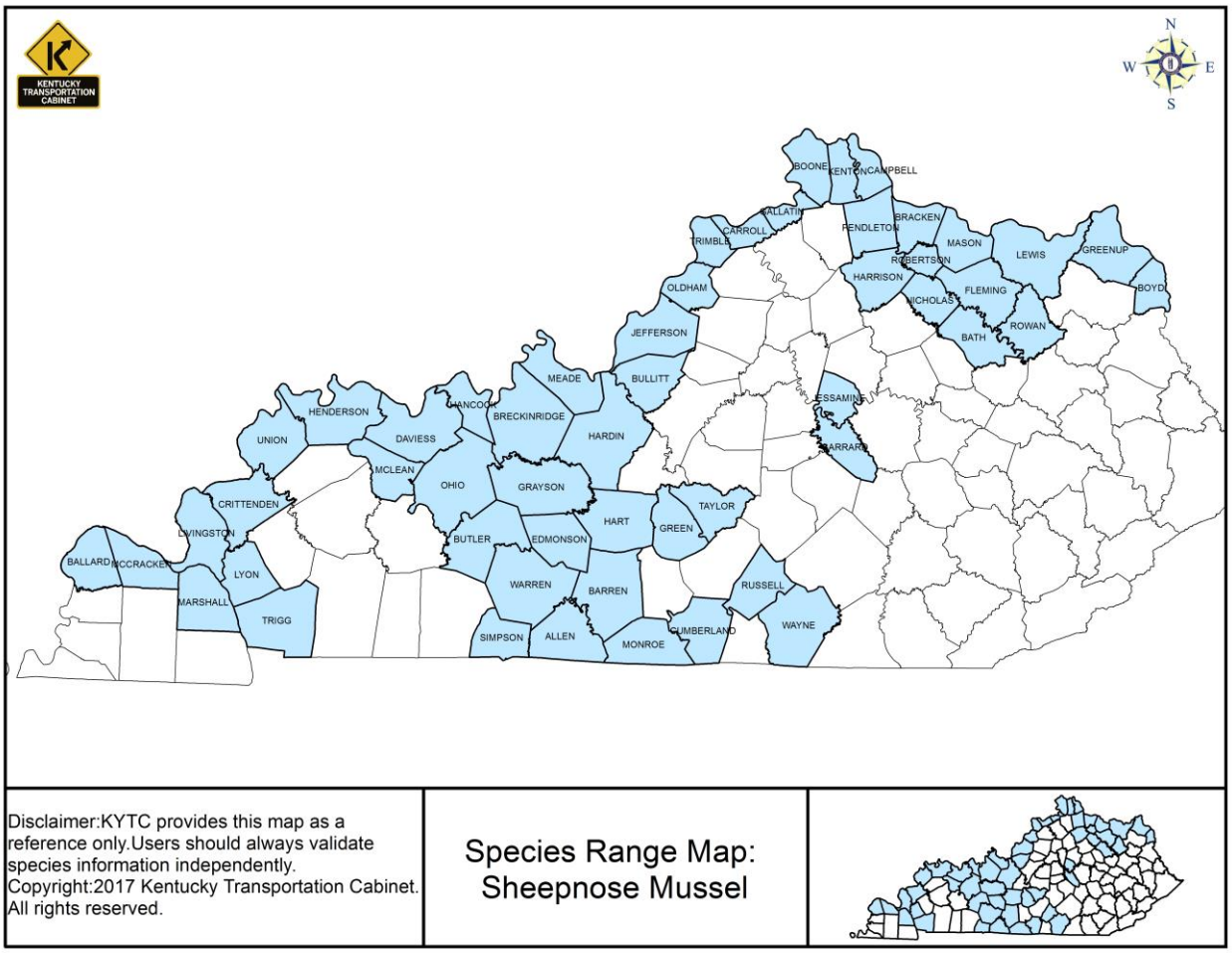
The sheepnose is known from **medium to large rivers** in sand, mud, and gravel. More specifically, the habitat can be described as rivers in gravel substrates with swift to moderate current.

## Critical Habitat

None

## Range

The sheepnose occurs nearly statewide, but sporadically. It ranges in the United States from northern Alabama into Minnesota and Wisconsin. In Kentucky, it is more specifically associated with the larger rivers around the state: Kentucky, Cumberland, Licking, Ohio, Tennessee, Green, and Barren Rivers.




## Decision Key

1) Does the project include any direct or indirect effects to **medium to large rivers or their nearby tributaries**? (e.g. – remove riparian vegetation, alter stream banks, change water levels/flow, dredge, construct/remove bridge piers, etc.)

    a. Yes: Contact SME
    b. No: Prepare NE finding

# Slabside Pearlymussel (*Pleuronaia dolabelloides*)

AKA: *Lexingtonia dolabelloides*

## Species Description

The slabside pearlymussel was listed as **endangered** in October of 2013.

Photo Credit: http://www.auburn.edu/academic/science_math/cosam/collections/invertebrates/collections/species/unionoida/images/Ldollabelloides.JPG

Although generally subtriangular in shape, this mussel exhibits considerable variability in shell shape. Shells are moderately inflated and very solid. Umbos are prominent, arched forward, and located near the anterior end. The shell is often irregularly and concentrically sculptured as a result of the pronounced growth rings. The periostracum is greenish-yellow (in juveniles) to brownish with a few broken green rays, or blotches, in some specimens. The nacre is white to straw colored. Cardinal teeth are large and serrated; lateral teeth thick and curved. Length 3-3.5 inches.

## Habitat Description

The slabside pearlymussel inhabits **small streams to large rivers** in sand and gravel. The most suitable habitat is likely that of a moderately strong current and a substrate composed of sand, fine gravel, and cobble.

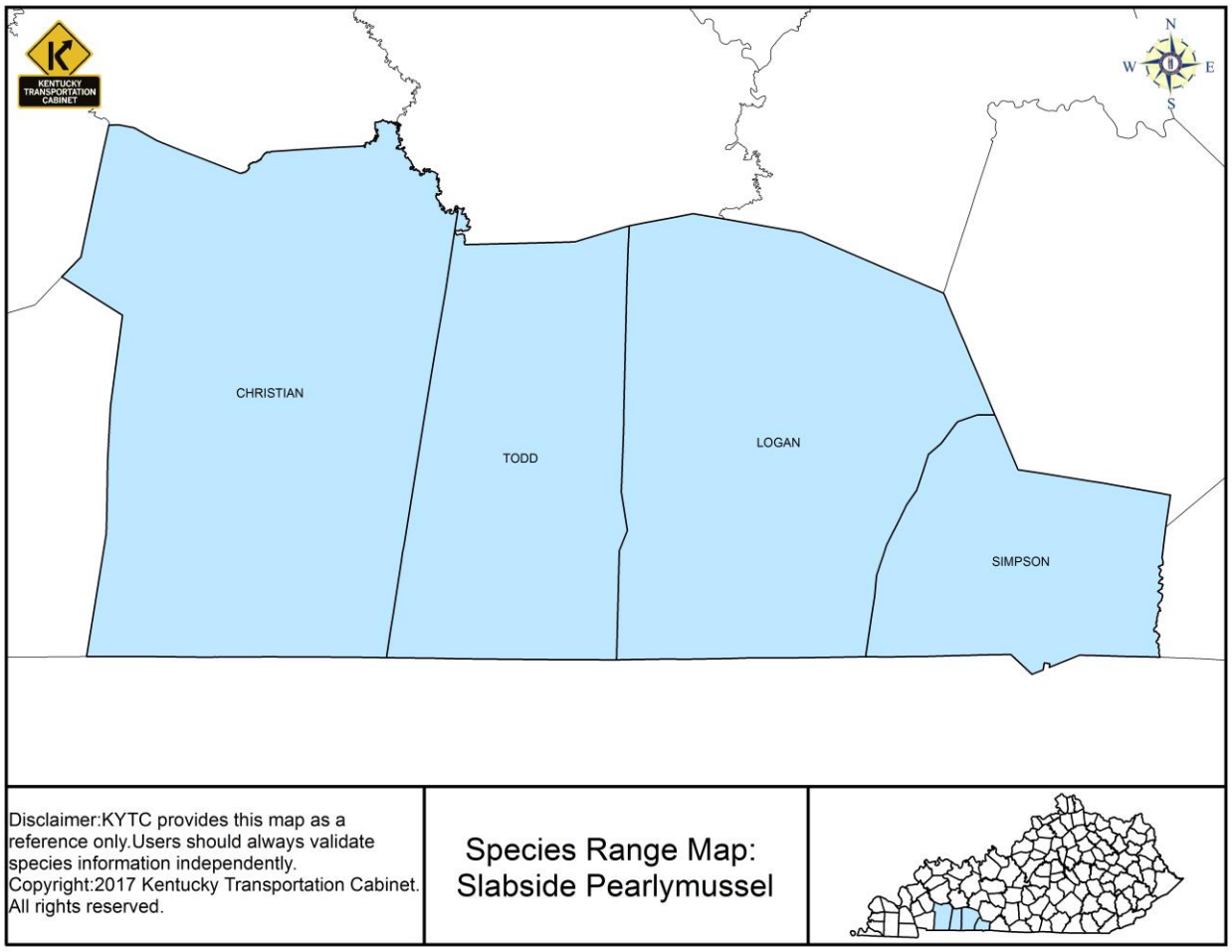
## Critical Habitat

Yes

***No critical habitat for this species occurs in Kentucky.***

## Range

The slabside pearlymussel is a Tennessee and Cumberland River endemic. In Kentucky, it may be extirpated, but has the potential to occur within the Lower Cumberland River system.




## Decision Key

1) Does the project include any direct or indirect effects to any **perennial streams or rivers or their nearby tributaries**? (e.g. – remove riparian vegetation, alter stream banks, change water levels/flow, dredge, construct/remove bridge piers, etc.)

    a. Yes: Contact SME
    b. No: Prepare NE finding

# Snuffbox Mussel (*Epioblasma triquetra*)

## Species Description

The snuffbox mussel was listed as **endangered** by the USFWS on February 14, 2012.

Photo Credit:
http://wwx.inhs.illinois.edu/collections/mollusk/publications/guide/index/162

The shape of the shell is somewhat triangular (females), oblong, or ovate (males), with the valves solid, thick, and very inflated. The umbos are located somewhat anterior of the middle, and are swollen, turned forward and inward, and extended above the hinge line. The anterior end of the shell is rounded, and the posterior end is truncated, highly so in females. The posterior ridge is prominent, being high and rounded, while the posterior slope is widely flattened. The posterior ridge and slope in females is covered with fine ridges and grooves, and the posterioventral shell edge is finely toothed. The shell is yellow or yellowish-green and covered with dark green rays or chevrons. The nacre is white or with a slightly iridescent bluish-white. Cardinal teeth are relatively large and serrated; lateral teeth are thick and short.

## Habitat Description

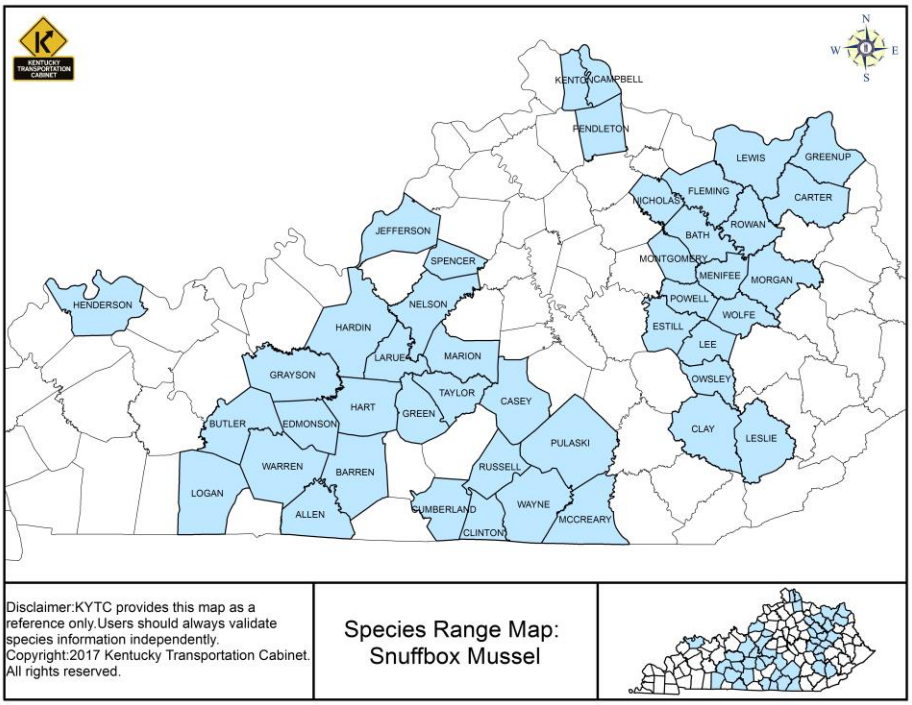
The snuffbox is usually found in **small streams to medium-sized rivers**, inhabiting areas with a swift current, although it is also found in Lake Erie and some larger rivers. Adults often burrow deep in sand, gravel or cobble substrates, except when they are spawning or the females are attempting to attract host fish. They can be found in water as shallow as 2 inches to 2 feet, usually in shallower areas of moderate to swiftly flowing streams.

## Critical Habitat

None

## Range

The snuffbox historically occurred in 210 streams and lakes in 18 States and 1 Canadian province: Alabama, Arkansas, Illinois, Indiana, Iowa, Kansas, Kentucky, Michigan, Minnesota, Mississippi, Missouri, New York, Ohio, Pennsylvania, Tennessee, Virginia, West Virginia, and Wisconsin; and Ontario, Canada. The major watersheds of historical streams and lakes of occurrence include: the upper Great Lakes sub-basin (Lake Michigan drainage), lower Great Lakes sub-basin (Lakes Huron, Erie, and Ontario drainages), upper Mississippi River sub-basin, lower Missouri River system, Ohio River system, Cumberland River system, Tennessee River system, lower Mississippi River sub-basin, and White River system. Extant populations of the snuffbox are known from 79 streams in 14 States and 1 Canadian province, representing a 62% decline in occupied streams. In Kentucky, snuffbox is associated with the river systems of the Licking, Green, Tygarts, Kinniconick, Little Sandy, Red(s), Barren, Cumberland, Salt, Rolling Fork, and parts of the Rockcastle River. Distribution is sporadic and nearly statewide.



## Decision Key

1) Does the project include any direct or indirect effects to **perennial streams or their nearby tributaries**? (e.g. – remove riparian vegetation, alter stream banks, change water levels/flow, dredge, construct/remove bridge piers, etc.)

    a. Yes: Contact SME
    b. No: Prepare NE finding

# Spectaclecase Mussel (*Margaritifera monodonta*)

AKA: *Cumberlandia monodonta*

## Species Description

The spectaclecase was listed as **endangered** on March 13, 2012.

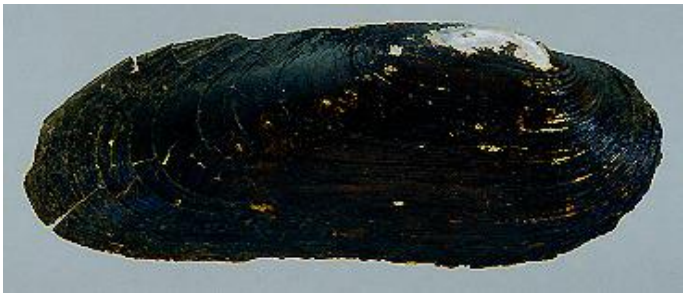


Photo Credit:
http://wwx.inhs.illinois.edu/collections/mollusk/publications/guide/index/22

The spectaclecase is a member of the mussel family Margaritiferidae. It is the only mussel in this family in Kentucky.

The shape of the shell is greatly elongated, sometimes arcuate (curved), and moderately inflated, with the valves being solid and moderately thick, especially in older individuals. Both anterior and posterior ends of the shell are rounded with a shallow depression near the center of the shell. The anterior end is higher than the posterior end. The posterior ridge is low and broadly rounded. Year-one specimens have heavy ridges running parallel with the growth arrests, which are shell lines that indicate slower periods of growth, thought to be laid down annually. The periostracum is somewhat smooth, rayless, and light yellow, greenish-tan, or brown in young specimens, becoming rough and dark brown to black in old shells. The shell commonly will crack posteriorly when dried. Cardinal teeth are greatly reduced, with a single peg-like tooth in the right valve fitting into a depression in the left. Lateral teeth are evident in younger specimens, but merge into a thickening of the hinge line in older specimens. Length 6-7 inches.

## Habitat Description

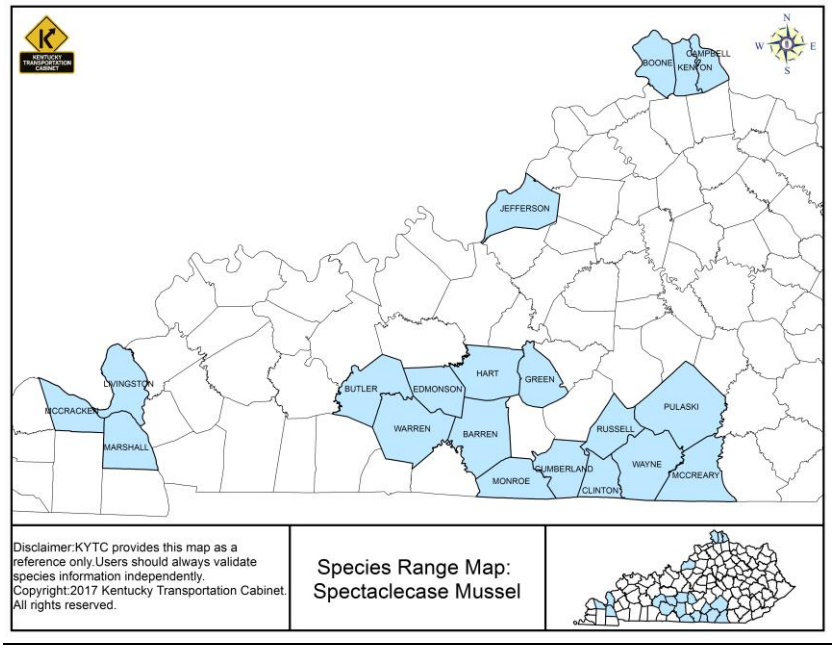
The spectaclecase generally inhabits **medium streams to large rivers**, and is found in microhabitats sheltered from the main force of current. It occurs in substrates from mud and sand to gravel, cobble, and boulders in relatively shallow riffles and shoals with a slow to swift current. This species is usually found in firm mud between large rocks in quiet water very near the interface with swift currents. Specimens have also been reported in tree stumps, in root masses, and in beds of rooted vegetation. Similar to other Margaritiferids, spectaclecase occurrences throughout much of its range tend to be aggregated, particularly under slab boulders or bedrock shelves, where they are protected from the current. Up to 200 specimens have been reported from under a single large slab in the Tennessee River at Muscle Shoals, Alabama.

## Critical Habitat

None

## Range

The spectaclecase has declined rangewide, with the exception of a few significant populations. Its occurrence in the St. Croix, Meramec, Gasconade, and Clinch Rivers represent the only sizable, sustainable, and reproducing populations remaining, although the Clinch River population appears to be in decline. It has been eliminated from three-fifths of the total number of streams from which it was historically known. This species has also been eliminated from long reaches of former habitat in thousands of miles of the Illinois, Ohio, Cumberland, and other rivers, and from long reaches of the Mississippi and Tennessee Rivers. In addition, the species is no longer known from the States of Ohio, Indiana, and Kansas. The extirpation of this species from numerous streams and stream reaches within its historical range signifies that substantial population losses have occurred. In Kentucky, it is considered to have the potential to occur in the Cumberland, Green, Tennessee, and parts of the Ohio and Licking Rivers.




## Decision Key

1) Does the project include any direct or indirect effects to **perennial streams or their nearby tributaries**? (e.g. – remove riparian vegetation, alter stream banks, change water levels/flow, dredge, construct/remove bridge piers, etc.)

    a. Yes: Contact SME
    b. No: Prepare NE finding

# Tan Riffleshell Mussel (*Epioblasma walkeri*)

AKA: *Epioblasma florentina walkeri*

Photo Credit: http://www.dinkinsbiological.com/kentucky.html

## Species Description

The tan riffleshell mussel was listed as **endangered** in 1977.

The tan riffleshell has an elongated oval shape, and is moderately inflated. The shell is thicker anteriorly. The anterior margin is rounded, while the posterior margin is blunted pointed (males) or broadly rounded (females). Umbos are full, anterior, and slightly above the hinge line. The shell is smooth, shiny, and tanish-green with numerous fine, green rays. Cardinal teeth are small and serrated; lateral teeth are short and slightly curved. Length 1.5-2 inches.

## Habitat Description

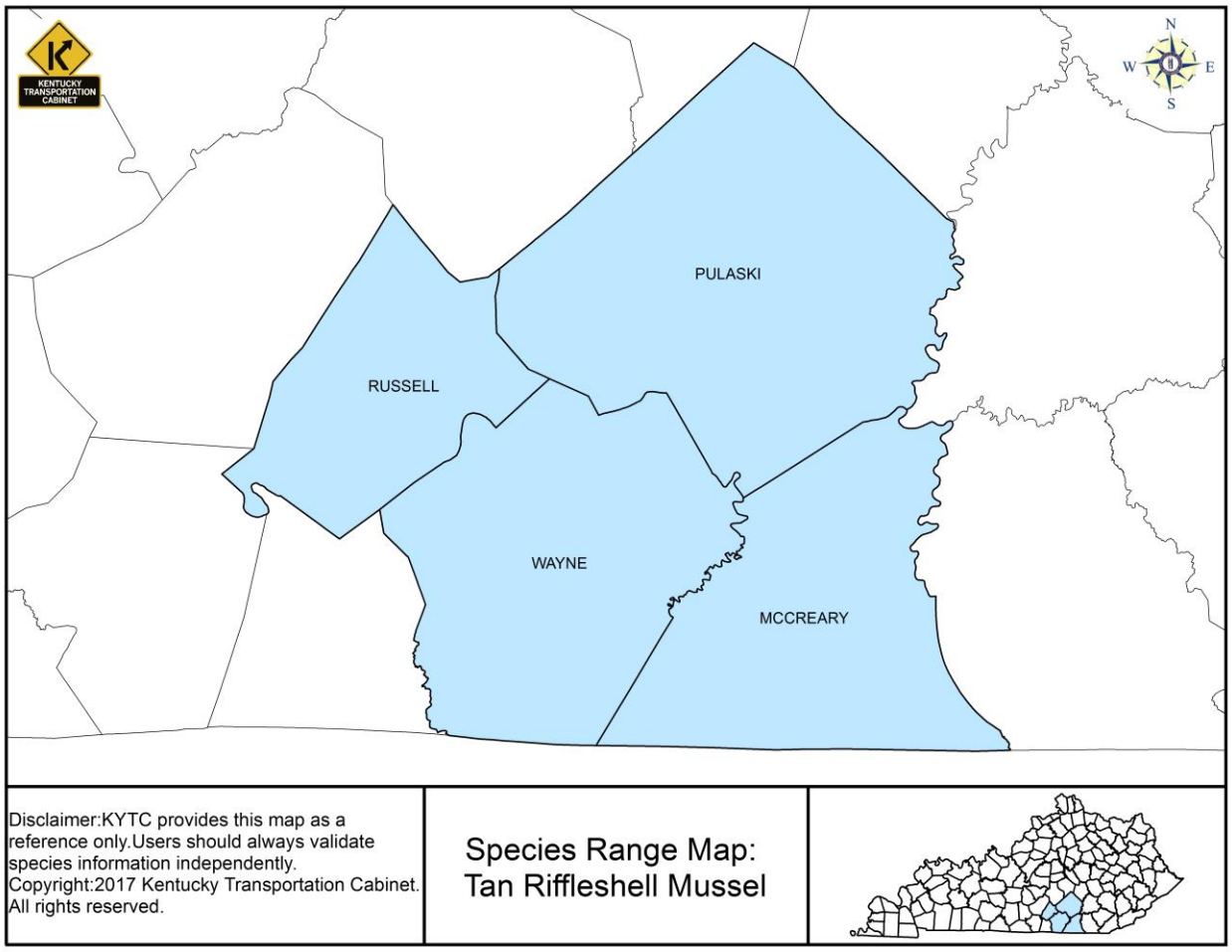
This is an ecologically variable species that ranges from the headwaters of small rivers to the main channel of bigger rivers. It is likely a riffle and shoal species living in sand and gravel substrates.

## Critical Habitat

None

## Range

The tan riffleshell is a Tennessee and Cumberland River endemic. In Kentucky, it is associated with the Upper Cumberland River system below the falls.




## Decision Key

1) Does the project include any direct or indirect effects to **perennial streams or their nearby tributaries**? (e.g. – remove riparian vegetation, alter stream banks, change water levels/flow, dredge, construct/remove bridge piers, etc.)

    a. Yes: Contact SME
    b. No: Prepare NE finding

# White Wartyback Mussel (*Plethobasus cicatricosus*)

## Species Description

Photo Credit:
http://wwx.inhs.illinois.edu/collections/mollusk/publications/guide/index/52

The white wartyback was listed as **endangered** in 1976.

Some specimens of white wartyback can easily be confused with the sheepnose mussel (*Plethobasus cyphyus*). The shells are subovate in outline, thick, solid, and moderately inflated. Umbos are high and full, and turned toward the anterior. The posterior ridge is low, narrowly rounded where it ends in a blunt point. The surface of the shell is marked with low, uneven, concentric growth lines and a row of irregular knobs restricted to the middle of the shell, leaving the anterior and posterior slopes of the shell free of sculpture. Shell is a yellowish-brown color. Cardinal teeth are large and serrated; lateral teeth are short and straight to slightly curved. Length 4-5 inches.

## Habitat Description

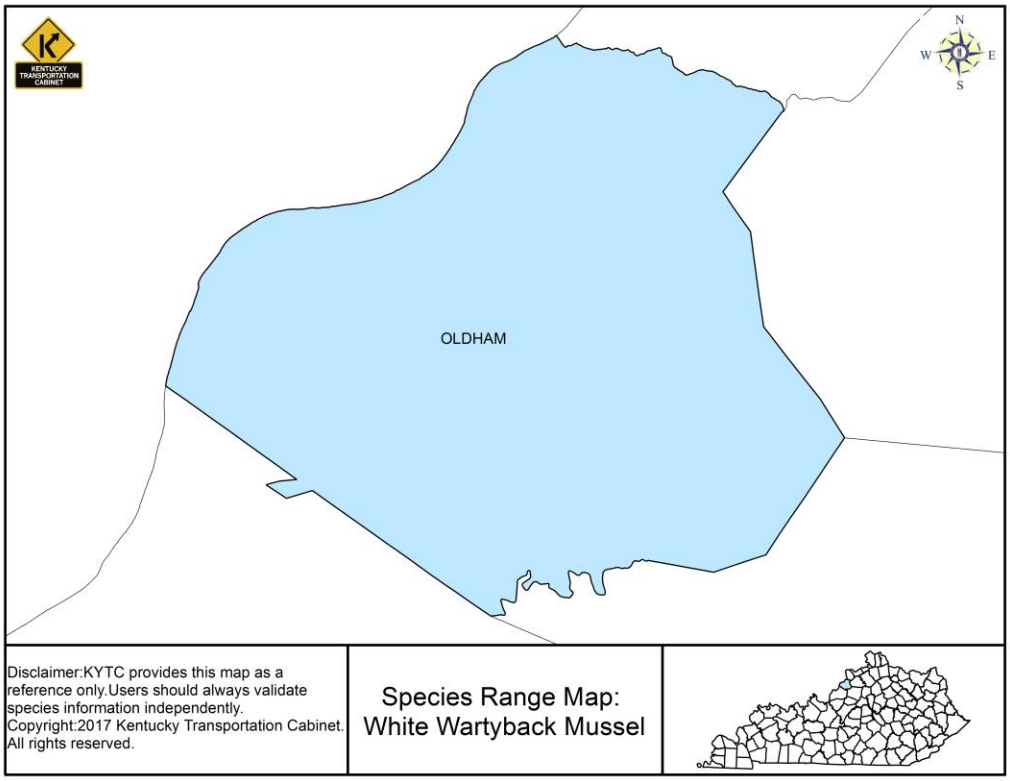
This species is considered a **big river shoal species**, often living in sand and gravel substrates.

## Critical Habitat

None

## Range

Historically, the white wartyback occurred in the Ohio, Cumberland, and Tennessee River systems. This mussel is extremely rare. The last collected specimens from the Tennessee River were in the mid-1960's, and the last specimen from the Cumberland River was in 1885. Several surveys on the Ohio River also yielded no white wartybacks, but they are still considered as potentially present in a small portion of the Ohio River. A non-essential, experimental population has been established in portions of the French Broad and Holston Rivers in Tennessee. It is considered to have the potential to occur only in Oldham County, KY.




## Decision Key

1) Does the project include any direct or indirect effects to any **medium to large rivers or their nearby tributaries**? (e.g. – remove riparian vegetation, alter stream banks, change water levels/flow, dredge, construct/remove bridge piers, etc.)

    a. Yes: Contact SME
    b. No: Prepare NE finding

# Winged Mapleleaf Mussel (*Quadrula fragosa*)

## Species Description

Photo courtesy:
http://wwx.inhs.illinois.edu/collections/mollusk/publications/guide/index/28

The winged mapleleaf was listed as **endangered** in 1991.

The shell of the winged mapleleaf is squarish in outline, solid, and moderately inflated. It resembles the mapleleaf mussel (*Quadrula quadrula*), and the most distinguishing characteristic that separates these two mussels is the pronounced wing or expanded posterior slope and its sculpturing of the winged mapleleaf. The umbo is high, full, and turned anteriorly. The shell has a radical sulcus with two rows of several, large raised tubercules on either side of the sulcus. Small, scattered pustules may be scattered on the umbo and posterior wing of the shell. The expanded posterior wing will likely consist of a few, irregular nodulose ribs. The periostracum is yellow, or brown, to green in color, sometimes with green rays. Cardinal teeth are large and serrated; lateral teeth are thick and short and roughened. Length 4-5 inches.

## Habitat Description

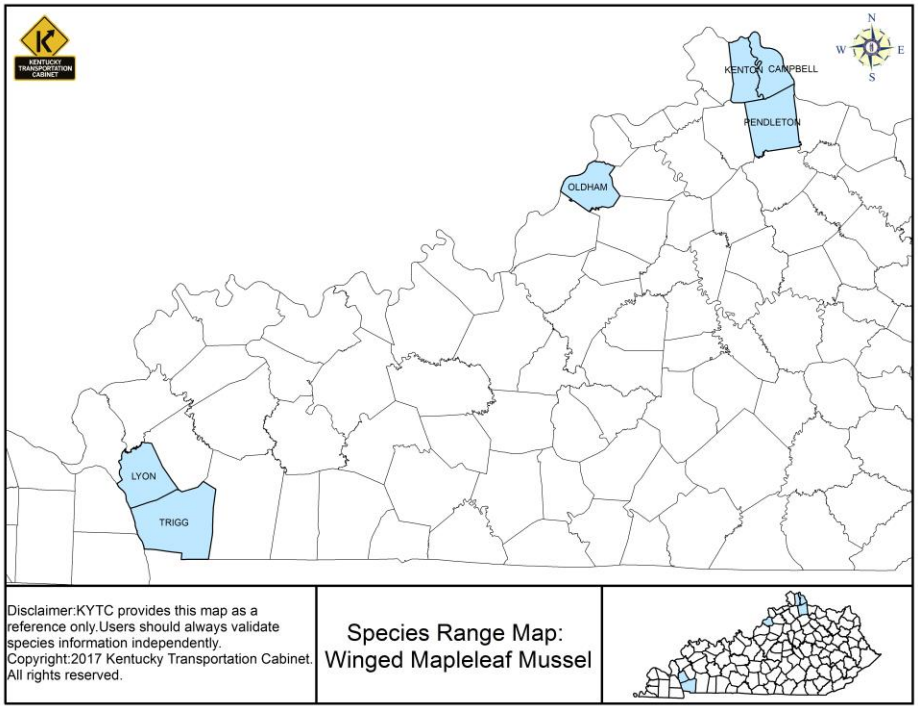
This species occurs in **medium to large rivers** in substrates of mud, sand, or gravel. It may occur in slow moving or fast flowing river stretches.

## Critical Habitat

None

## Range

The winged mapleleaf has undoubtedly been confused with the mapleleaf mussel in historic surveys. Some scientists believe these two species are not distinct. Despite a unanimous taxonomic agreement, USFWS considers these species distinct and awarded the winged mapleleaf endangered status. The ESA as amended defines "species" to include subspecies and distinct populations of species. In this regard, the winged mapleleaf meets the criteria for species as concerned with the ESA. Historically, the winged mapleleaf has been reported from 34 rivers in 12 states. Largely, it is considered to occur in suitable habitat of rivers in the Upper Mississippi River drainage. For Kentucky, this means it is considered to potentially occur in parts of the Ohio, Licking, and Tennessee Rivers. A non-essential, experimental population has been established in the Tennessee River in Alabama below the Wilson Dam.




## Decision Key

1) Does the project include any direct or indirect effects to any **medium to large rivers or their nearby tributaries**? (e.g. – remove riparian vegetation, alter stream banks, change water levels/flow, dredge, construct/remove bridge piers, etc.)

    a. Yes: Contact SME
    b. No: Prepare NE finding

# Extirpated Mussel Species

*The following endangered mussels are considered extirpated in Kentucky. As a result, these are not identified as potentially existing within any Kentucky County. Surveys specifically for these mussels will not be conducted. However, should a specimen be found as a result of survey efforts for other listed species, they will be considered in the consultation with the USFWS.*

## White Catspaw Mussel (*Epioblasma perobliqua*)

The white catspaw mussel (formerly *Epioblasma obliquata perobliqua*) was listed as **endangered** in 1976. This mussel is considered a medium-to-large river mussel that may have occurred in the Ohio River.

Photo Credit:
http://www.fws.gov/midwest/endangered/clams/white_fc.html

## Yellow Blossom (*Epioblasma florentina*)

The yellow blossom mussel (formerly *Epioblasma florentina florentina*) was listed as **endangered** in 1976. This mussel exists in medium sized to large rivers in sand and gravel. It is formerly of the upper Cumberland River below Cumberland Falls. A non-essential, experimental population has been established in Alabama.

Photo Credit:
http://musselproject.uwsp.edu/db/db/php?p=div&l=spp&n=1055

## Tubercled Blossom (*Epioblasma torulosa*)

The tubercled blossom (formerly *Epioblasma torulosa torulosa*) was listed as **endangered** in 1976. This is a medium to large river mussel that lived in substrates of sand and gravel. It is formerly of the Ohio, Tennessee, Cumberland, Green, Salt, Licking, and Kentucky Rivers in Kentucky. A non-essential, experimental population has been established in Alabama.

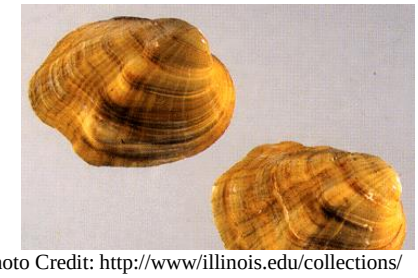


Photo Credit: http://www/illinois.edu/collections/mollusk/publications/guide/index/166

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http://ecos.fws.gov/speciesProfile

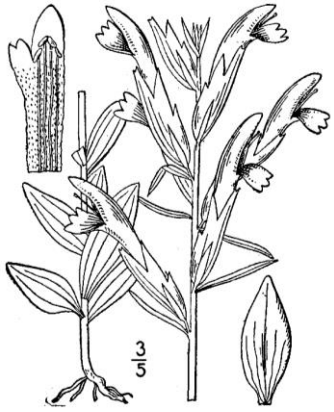
# American Chaffseed (*Schwalbea americana*)

## Species Description

Photo Credit: Jim Stasz, http://plants.usda.gov

American chaffseed (*Schwalbea americana*) was listed as **endangered** on September 29, 1992.

A member of the Figwort family (*Scrophulariaceae*), American chaffseed is an erect, perennial herb 30-80 cm (12 to 31 inches) tall. It is often unbranched or branched only at the base. The leaves are alternate, lance-shaped to elliptic, stalkless, and 2-5 cm (1-2 inches) long. American chaffseed is clearly but minutely hairy throughout, including the flowers.



Britton and Brown (1913)

American chaffseed is a dicot with large, purplish-yellow, tubular flowers. The flowers are singly on short stalks in the axils of the uppermost reduced leaves (bracts) form a many-flowered, spike-like raceme. Flowers typically bloom from April to June in the South and June to mid-July in the North. Pedestrian surveys should be conducted during this time in areas of favorable habitat.

American chaffseed is considered to be a hemiparasite. Hemiparasites are plants that are partially dependent on its host. American chaffseed is not host specific and thus is hemiparasitic nature is not the main factor contributing to its rarity.


Photo: Hugh and Carol Nourse, http://www.fs.fed.us


Photo Credit: Guy Anglin, http://www.fs.fed.us

## Habitat Description

American chaffseed is a native species, but it is now only known historically to Kentucky. There are approximately 16 known extant sites supporting this species within the United States.

American chaffseed prefers habitat areas with sandy (sandy peat, sandy loam), acidic, seasonally moist to dry soils. Most sites are described as open, moist pine flatwoods, fire-maintained savannas, transition areas between peaty wetlands and xeric sandy soils, and other open grass-sedge systems. Additionally, one known site occurs in heavy clay soil of a hayfield in Mississippi. Historically, the species occurred in savannas and pinelands throughout the coastal plains and also could be found on sandstone knobs and inland plains were frequent fire events naturally occurred and maintained these habitat characteristics. American chaffseed is considered to be a shade intolerant species and relies on activities such as fire, mowing, or fluctuating water tables to maintain the open to partially-open habitat conditions that it requires.

American chaffseed is often associated with species-rich plant communities dominated by grasses and sedges. Common species associations in the Southeast include grass species of *Andropogon*, *Aristida*, *Panicum* and *Paspalum*; sedge species of *Carex*, *Dichromena*, *Fimbristylis*, *Rhynchospora*, *Scleria*; monocot species of *Aletris*, *Calopogon*, *Eriocaulon*, *Juncus*, *Lachnocaulon*, *Xyris*; and dicot species of *Asclepias*, *Buchnera*, *Erigeron*, *Eryngium*, *Helenium*, *Heterotheca*, *Orbexilum*, *Phlox*, and *Polygala* (Center for Plant Conservation Website). In wetter habitats, common species associations include species of *Cliftonia*, *Gaylussacia*, *Ilex*, *Lyonia*, *Leucothoe*, *Myrica*, and *Vaccinium*.

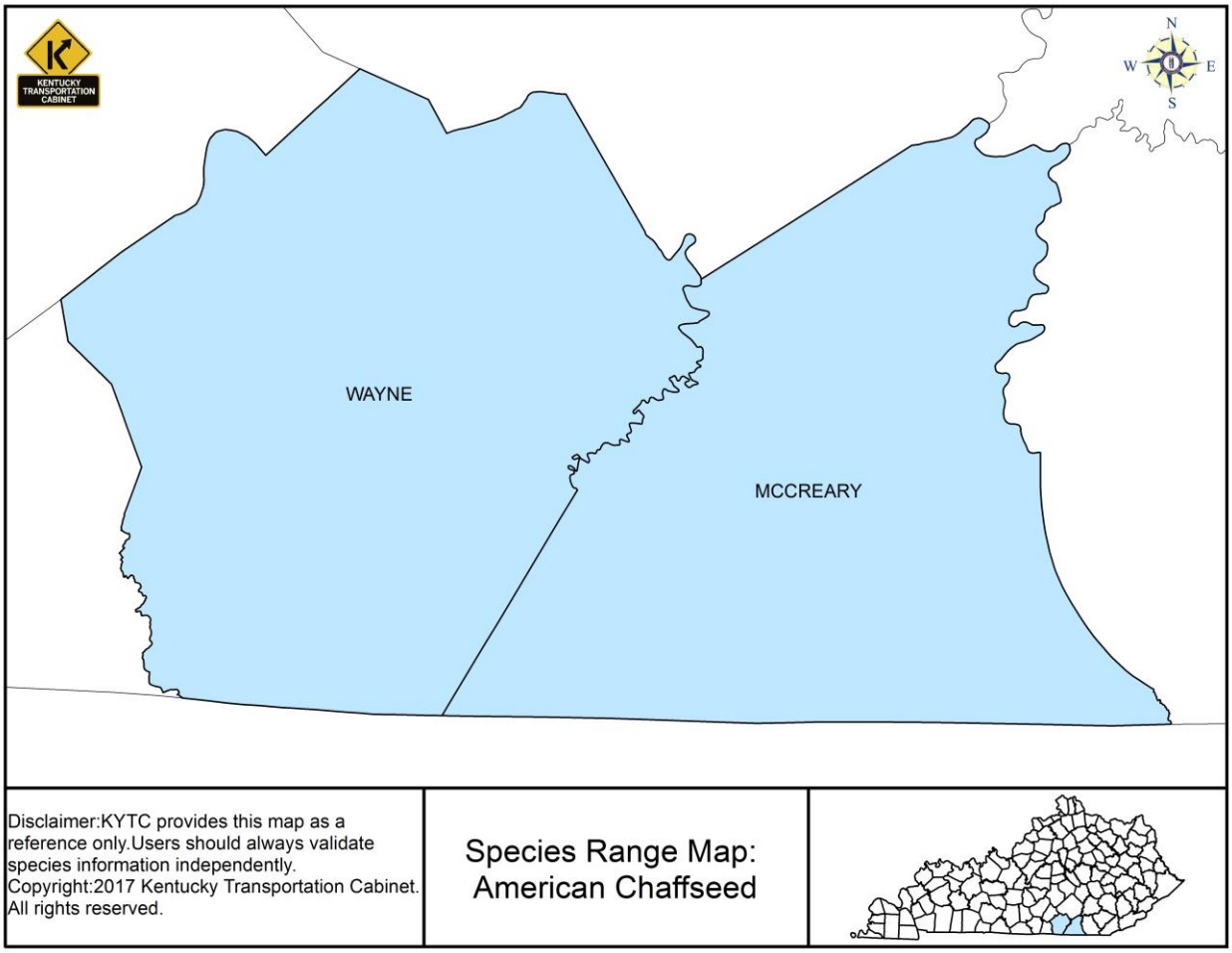
Threats to American chaffseed habitat may include activities such as conversion to residential and agricultural development, inappropriate mowing regimes, fire suppression, woody vegetation competition, over-collection, and trampling.

## Critical Habitat

None

## Range

American chaffseed is a native species with extant populations known within Florida, Georgia, Mississippi, New Jersey, North Carolina, and South Carolina. The species is also historically known within Alabama, Connecticut, Delaware, Kentucky, Maryland, Massachusetts, New York, Tennessee and Virginia. It is listed as a historical species in Kentucky. Currently, this species is listed for 2 counties in southeastern Kentucky.



## Decision Key

1) Does the project area occur in open, moist pine flatwoods, fire-maintained savannas, transitional areas between peaty wetlands and xeric sandy soils, or other open grass-sedge systems?

    a. Yes: Continue to Step 2
    b. No: Prepare NE finding

2) Does the area contain open to partially-shaded conditions and limited competition by other plant species?

    a. Yes: Contact SME
    b. No: Prepare NE finding

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# Braun's Rock-cress (*Arabis perstellata* var. *perstellata*)

## Species Description

Braun's rock-cress (*Arabis perstellata* var. *perstellata*) was listed as **endangered** on January 3, 1995.

A member of the Mustard family (*Brassicaceae*), Braun's rock-cress is a relatively short, perennial herb that grows in calcareous, mesophytic, and sub-xeric forest. The plant can reach a height of 30 inches but is generally much shorter. It can be recognized in the field during all seasons since it maintains a rosette of small leaves all year-round. The rosette is formed the first year following germination and remains green during the winter months. The following year a stem is produced from the rosette and a taproot becomes established. In subsequent years, new growth is produced, especially additional branching and stems. Plants are reported to live up to five years. The elongate raceme has many flowers. Each flower has four petals 3-4 mm in length, white to lavender in color. This species is most easily recognized when blooming, usually from April through May. Fruits mature from mid-May to early June.


Photo Credit: Ellen Mullins, KYTC, Environmental Analysis

## Habitat Description

Braun's rock-cress is typically found in mesic or xeric deciduous forest on calcareous slopes with limestone outcroppings. The occurrence of this species does not appear to be limited to a particular slope aspect or moisture regime. It is, however, sun intolerant and always occurs in at least partial shade. The largest and most vigorous populations occur on moist mid-to-upper slope sites. Recent studies have shown that the species elevation range is from 520 feet to 868 feet, and the average elevation of known occurrences was 661.1 feet.

Braun's rock-cress showing bare ground around

Braun's rock-cress growing on a rock outcropping

Plants are often found around rock outcrops and can even be found growing from the strata lines and joints of outcrops. It is rarely found growing in leaf litter or in dense herbaceous cover of the forest floor. Localized and usually

Braun's rock cress, showing nearly bare ground only scattered leaf litter
Photo Credits: Third Rock Consultants, Lexington, KY

natural disturbance, such as animal trails, scouring, or even turkey scratching that reduces leaf litter or create bare ground appears to be necessary for this species germination and survival. Often the species can be found on the down-slope side of tree trunks where the leaf litter has been washed away and continues to be swept clean by trunk-flow.

With one exception, all Kentucky occurrences have been found on either the Grier or Tanglewood members of the Lexington Limestone Formation. Even where other members of the formation, those with a more substantial shale component (Clays Ferry), occur immediately adjacent, the plants are still confined to the Grier and Tanglewood. The exception is a population in Henry County, occurring on what is mapped as the Kope and Clays Ferry members that have a higher shale component than Lexington Limestone. The plants at this site occur on limestone outcrops, however, and the Calloway Creek limestone (75 to 85 percent limestone) is mapped at a slightly higher elevation on the slope above, so this habitat may be consistent with other sites in its higher limestone component. This geologic habitat is associated with the entrenched Kentucky River and the lower end of its direct tributaries. Such habitat only occurs within 6 miles of the River.

Sub-xeric (west aspect) slope habitat

Slope habitat with limestone outcroppings

Typical, partially shaded wooded slope

Photo Credits: Third Rock Consultants, Lexington, KY

Braun's rock-cress is never a common component of the forest floor community. It usually occurs in small groups (especially around and on rock outcrops) or as scattered individuals. The small size of the populations, the species' specialized habitat, and its apparent inability to expand into available or similar habitats suggest that Braun's rock-cress is a poor competitor. Although its habitat is usually disturbance-mediated, Braun's rock-cress is adapted to a highly specialized set of environmental conditions. It appears that this species cannot withstand vigorous competition from invasive weed or even native herbaceous species.

Partially shaded, mesic wooded slope habitat
Photo Credit: Third Rock Consultants, Lexington, KY

Common tree species associated with the slope forests where Braun's rock-cress habitat occurs include: sugar maple (*Acer saccharum*), chinquapin oak (*Quercus muhlenbergii*), northern hackberry (*Celtis occidentalis*), and Ohio buckeye (*Aesculus glabra*).

The most likely impacts associated with transportation projects are road cuts along steep slopes next to the Kentucky River or its tributaries. New corridor construction, widening that requires clearing, bridge replacements that require alteration of wooded, slope habitat, and borrow or fill areas that are located on wooded slopes (or ravines) are all activities that could also impact Braun's rock-cress. A change in surface or groundwater drainage may also affect plants occurring down-slope of a project by scouring or reducing soil moisture. Roadcuts typically intercept subsurface drainage, leaving the down-slope soils drier.

## Critical Habitat

Yes (*See more detailed information and maps provided after decision key*)

In 2004, the USFWS designated 17 units as critical habitat in Franklin and Owen Counties, KY.

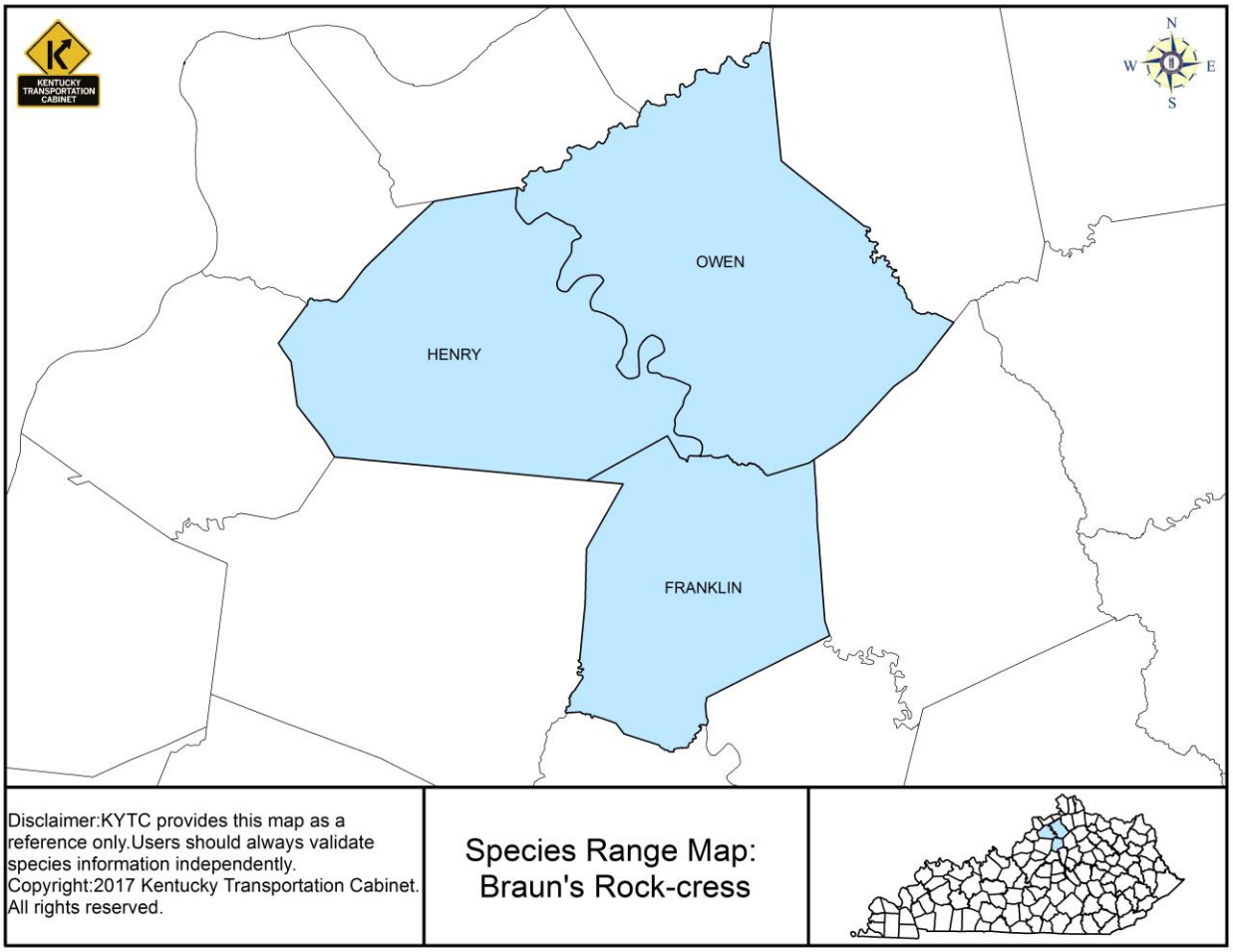
Primary constituent elements of critical habitat for this species include:

1) Relatively undisturbed, closed canopy mesophytic and sub-xeric forest with large, mature trees (such as sugar maple (*Acer saccharum*), chinquapin oak (*Quercus muhlenbergii*), hackberry (*Celtis occidentalis*), or Ohio buckeye (*Aesculus glabra*)), and
2) Open forest floors with little herbaceous cover and leaf litter accumulation with natural disturbance to allow for Arabis perstellata germination and seedling germination, and
3) Areas with few introduced weed species such as garlic mustard (*Alliaria petiolata)* or amur honeysuckle (*Lonicera maackii*), and
4) Rock outcrops on moderate to steep calcareous slopes defined by:
    a) Ordovician limestone, in particular the Grier, Tanglewood, and Macedonia Bed Members of the Lexington Limestone in Kentucky and the Lebanon Carters, Leipers, and Catheys, and Bigby-Cannon Limestones in Tennessee; and
    b) Limestone soils such as the Fairmont Rock outcrop complexes in Kentucky and the Mimosa Rock outcrop complexes in Tennessee.

| Critical Habitat Unit | County/State | Land Ownership | Hectares | Acres |
|---|---|---|---|---|
| 1. Sky View Drive | Franklin/Kentucky | Private | 22 | 54 |
| 2. Benson Valley Woods | Franklin/Kentucky | Private | 37 | 91 |
| 3. Red Bridge Ridge | Franklin/Kentucky | Private | 6 | 15 |
| 4. Trib. to South Benson Creek | Franklin/Kentucky | Private | 10 | 25 |
| 5. Davis Branch | Franklin/Kentucky | Private | 3 | 7 |
| 6. Onans Bend | Franklin/Kentucky | Private | 12 | 30 |
| 7. Shadrock Ferry Road | Franklin/Kentucky | Private | 15 | 37 |
| 8. Hoover Site | Franklin/Kentucky | Private | 83 | 205 |
| 9. Longs Ravine Site | Franklin/Kentucky | Private | 30 | 74 |
| 10. Strohmeiers Hills | Franklin/Kentucky | Private | 20 | 49 |
| 11. U.S. 127 | Franklin/Kentucky | EXTIRPATED | 11 | 27 |
| 12. Camp Pleasant Branch | Franklin/Kentucky | Private | 14 | 35 |
| 13. Saufley | Franklin/Kentucky | Private | 8 | 20 |
| 14. Clements Bluff | Owen/Kentucky | State | 11 | 27 |
| 15. Monterey U.S. 127 | Owen/Kentucky | Private | 12 | 30 |
| 16. Craddock Bottom | Owen/Kentucky | Private | 23 | 57 |
| 17. Backbone North | Franklin/Kentucky | Private | 11 | 27 |
| 18. Scales Mountain | Rutherford/Tennessee | Private | 103 | 255 |
| 19. Sophie Hill | Rutherford/Tennessee | Private | 53 | 132 |
| 20. Indian Mountain | Rutherford/Tennessee | Private | 87 | 214 |
| 21. Grandfather Knob | Wilson/Tennessee | Private | 43 | 106 |
| 22. Versailles Knob | Rutherford/Tennessee | Private | 34 | 83 |
| **Total** | --- | --- | **648** | **1,600** |

## Range

Braun's rock-cress is presently known from the Interior Plateau Level 3 ecoregion of Kentucky and Tennessee. These regions are geologically similar in that both are underlain with Ordovician limestones, the oldest geologic substrates in each of the states. In Kentucky, it is found in the Hills of the Bluegrass and Inner Bluegrass Level IV ecoregions. Currently, this species is listed for three counties in Kentucky.



## Decision Key

*Office Review:*

1) Is the project located within a 6 mile buffer of the Kentucky River?

    a. Yes: Continue to Step 2
    b. No: Prepare NE finding

2) Is the project area within ¼ mile of a critical habitat unit?

    a. Yes: Contact SME
    b. No: Continue to Step 3

3) Is the project area on or adjacent to a steep slope (20 percent or more) and/or adjacent to the Grier, Tanglewood, Kope, or Clays Ferry members of the Lexington limestone?

    a. Yes: Continue to Step 4
    b. No: Prepare NE finding

*Field Assessment:*

4) Is the project area located on or where it may affect wooded slopes?

    a. Yes: Contact SME
    b. No: Prepare NE finding

## Literature Cited

Jones, R. L. 1991. Status survey report on *Arabis perstellata* var. *perstellata*. Prepared for Kentucky State Nature Preserves Commission, Frankfort, Kentucky, and U.S. Fish and Wildlife Service, Asheville, North Carolina.

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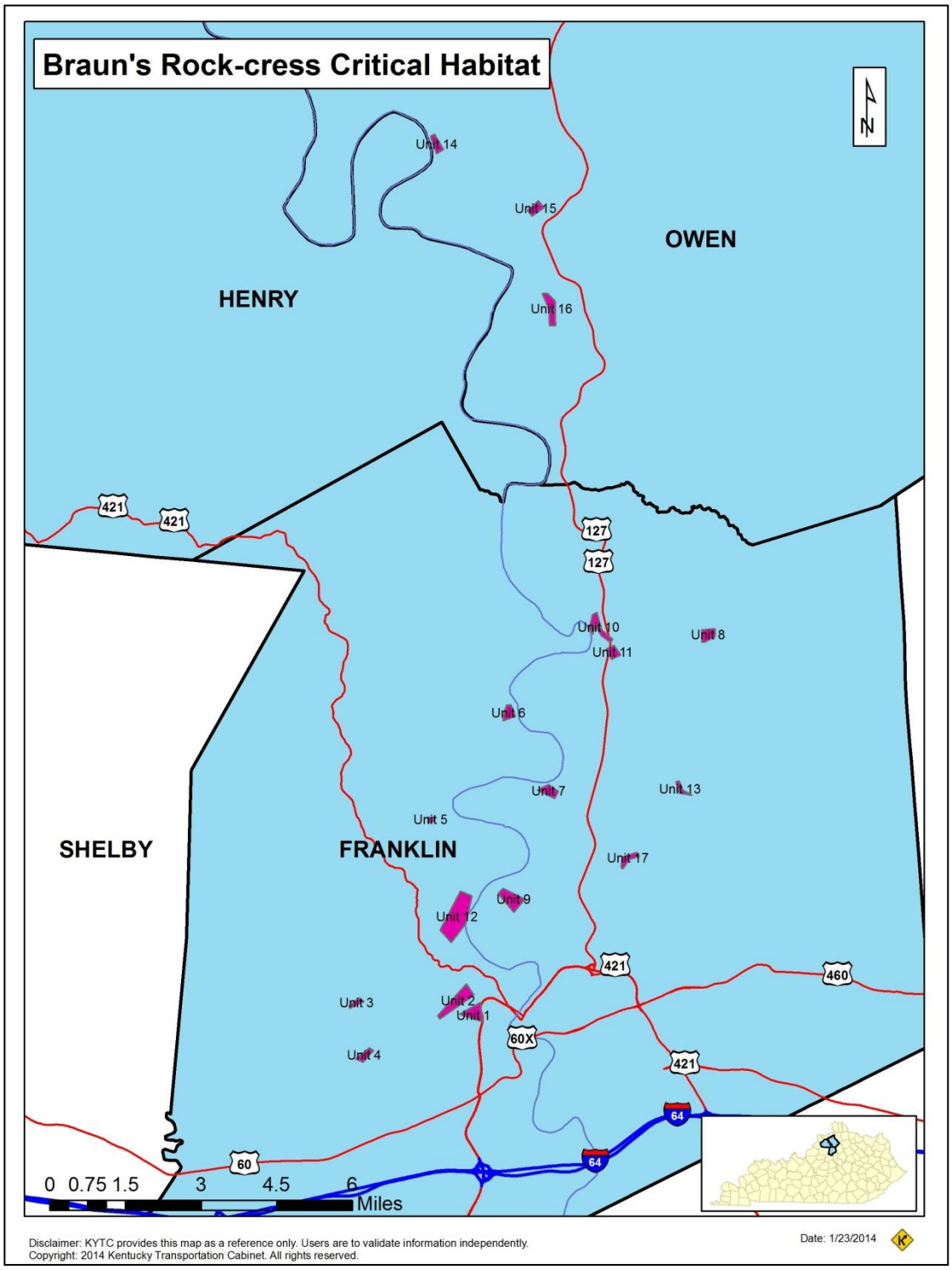
Woods, A.J., Omernik, J.M., Martin, W.H., Pond, G.J., Andrews, W.M., Call, S.M., Comstock, J.A., and Taylor, D.D. 2002. Ecoregions of Kentucky. Reston, VA. USGS.

Designated Critical Habitat (in Kentucky)



## Designated Critical Habitat

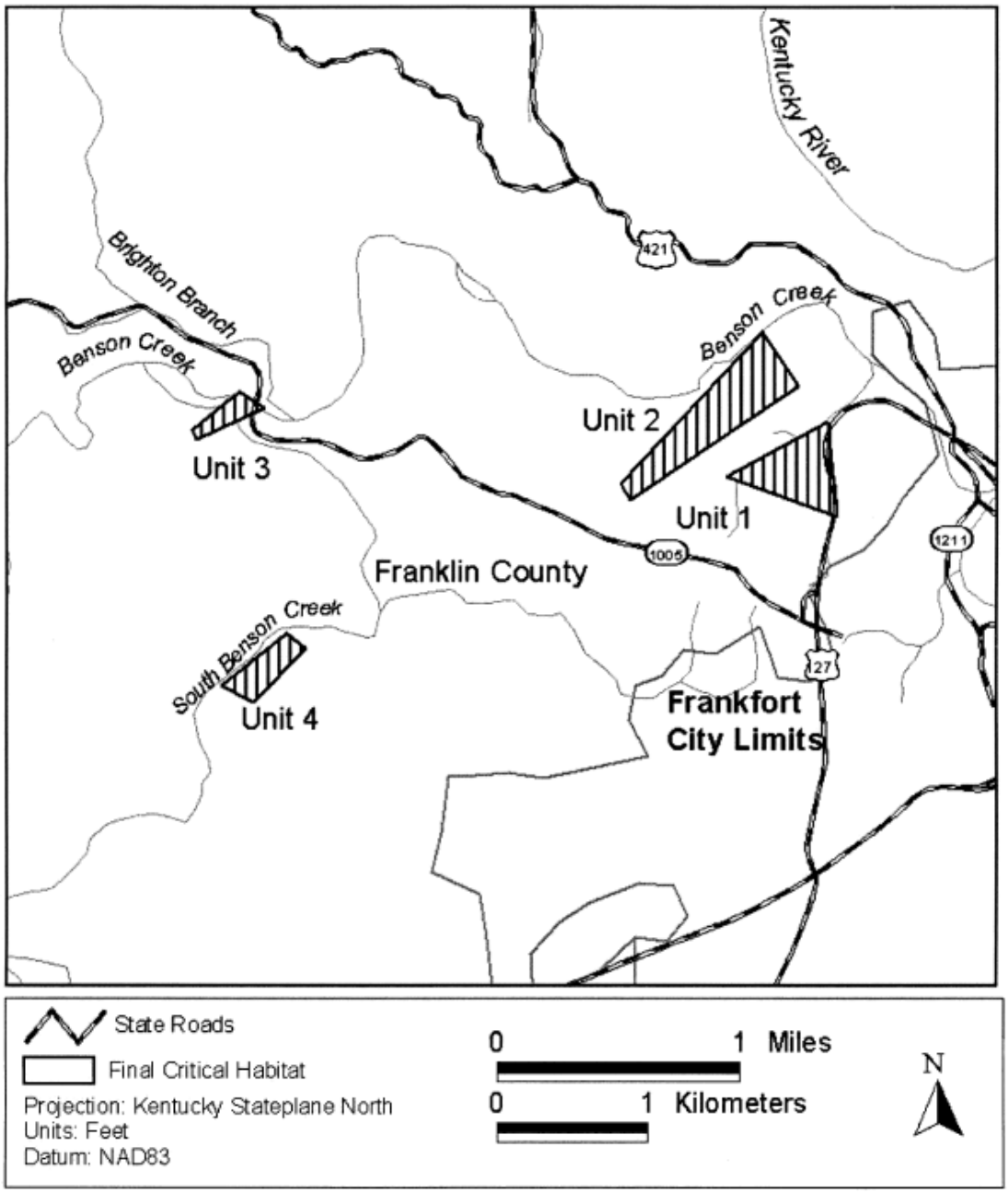
**Unit 1. Sky View Drive in Franklin County, Kentucky**
Unit 1 is located on the west side of the City of Frankfort. It occurs along U.S. 127 and Skyview Drive on the slopes of the first large ravine system due west of the confluence of Benson Creek and the Kentucky River. It contains approximately 22 ha (54 ac), all of which are privately owned. This site was first observed to have *Arabis perstellata* in 1979. In 2001, surveys conducted by the KSNPC found over 150 plants, but not all habitat was surveyed. The majority of the plants occur on the west- and south-facing sloped and are associated with bare soil on trails and tree bases.

**Unit 2. Benson Valley Woods in Franklin County, Kentucky**
Unit 2 is located west of the City of Frankfort. The unit lies southeast of Benson Valley Road on the south side of Benson Creek. It is privately owned and contains approximately 37 ha (91 ac). The plants occur on the southeast-facing slope. They were first observed in 1979. KSNPC personnel last observed more than 200 plants in 2001. The site is threatened by trampling and competition by weeds.

**Unit 3. Red Bridge Ridge in Franklin County, Kentucky**
Unit 3 is located west of Kentucky (KY) Highway 1005, at the confluence of South Benson and Benson Creeks. The site is privately owned. It is approximately 6 ha (15 ac) in size. Plants at this site were first observed in 1987. In 1990, 75 plants were found along the southeast- and northwest-facing slopes.

**Unit 4. Tributary to South Benson Creek in Franklin County, Kentucky**
This unit is located northeast of the City of Frankfort. It occurs along the southeast side of South Benson Creek and the north and south slopes of an unnamed tributary. The site is in private ownership and is 10 ha (25 ac) in size. In 1996, over 1,000 plants were found along the northwest-facing lower, mid, and upper slopes, making this one of the best sites in Kentucky for *Arabis perstellata*.

**Map 2 - Units 1, 2, 3 and 4: critical habitat for Braun's rock-cress in Kentucky.**



**Unit 5. Davis Branch in Franklin County, Kentucky**
This unit occurs along the east side of Harvieland Drive and Davis Branch. This unit contains approximately 3 ha (7 ac) and is privately owned. Plants were first observed at this site in 1990. In 2001, hundreds of plants were found along the south-facing slope throughout the ravine system.

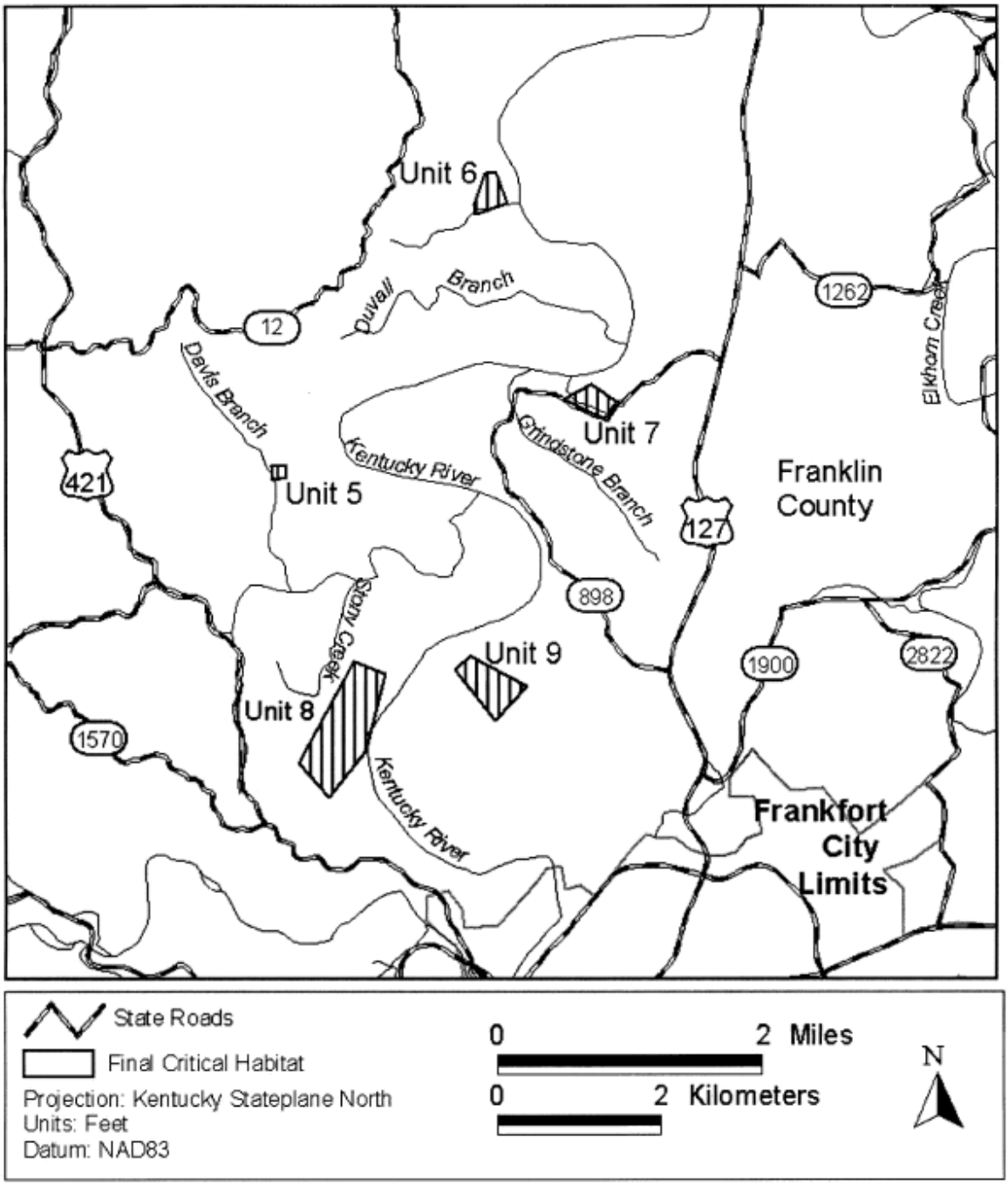
**Unit 6. Onans Bend in Franklin County, Kentucky**
Unit 6 occurs north of Onans Bend Road and east of KY Highway 12. The unit lies along the banks of an unnamed stream near its mouth with the west bank of the Kentucky River. This unit is privately owned and contains approximately 12 ha (30 ac). Plants at this unit were first observed in 1979. In 1990, more than 100 plants were found on the south-facing slope. The plants were exceptionally vigorous. The site is threatened by weed competition.

**Unit 7. Shadrock Ferry Road in Franklin County, Kentucky**
This unit is located along the north side of Shadrock Ferry Road (KY Highway 898). Property at this location is in private ownership. This unit is approximately 15 ha (37 ac) in size. Plants were first observed at this site in 1996. In 2001, several hundred plants were found on the south-facing slope.

**Unit 8. Hoover Site in Franklin County, Kentucky**
This unit lies northwest of the City of Frankfort, along the west side of the Kentucky River on slopes bordering two unnamed tributaries. Plants are widely scattered in small groups along the Kentucky River bluff from river kilometer (km) 98.6 to 101.7 (river mile 61.3 to 63.2). This unit is in private ownership and contains approximately 83 ha (205 ac). The plants were first observed in 1990. In 1996, hundreds of plants were found.

**Unit 9. Longs Ravine Site in Franklin County, Kentucky**
Unit 9 is located north of the City of Frankfort and Lewis Ferry Road. This unit lies east of the Kentucky River in a large ravine and along the steep slopes above the river. This unit is privately owned. There is approximately 30 ha (74 ac) in this unit. In 1990, more than 250 plants were found on the northeast, southwest, and northwest-facing slopes.

**Map 3 - Units 5, 6, 7, 8 and 9: critical habitat for Braun's rock-cress in Kentucky.**

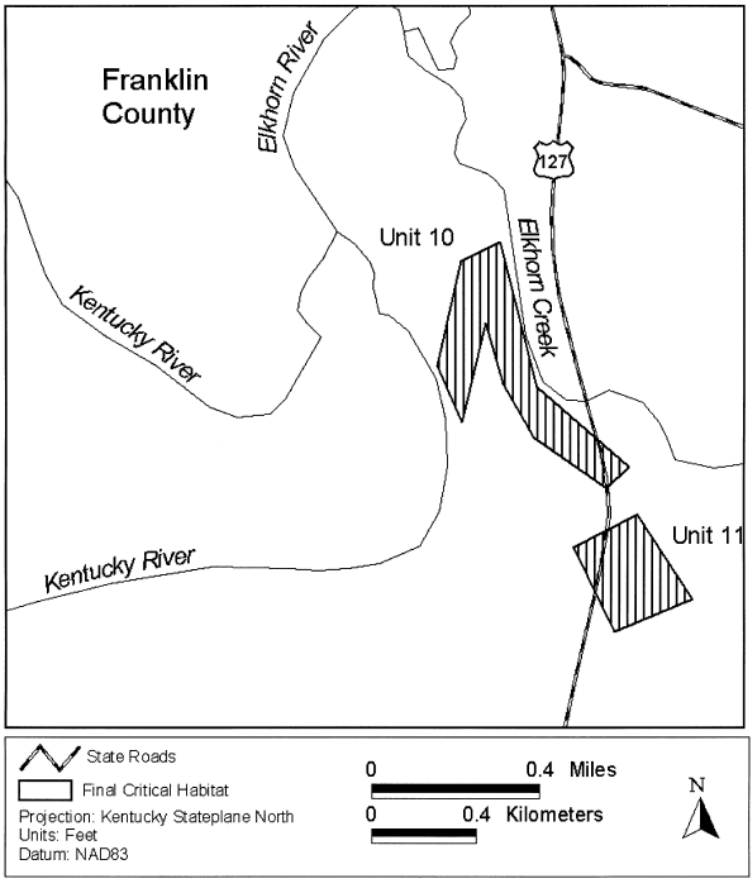


**Unit 10. Strohmeiers Hill in Franklin County, Kentucky**
This unit is located south of the Town of Swallowfield and adjacent to Strohmeier Road and U.S. 127. It occurs on steep slopes on the south side of Elkhorn Creek and on the east bank of the Kentucky River, south of the confluence with Elkhorn Creek. The plants at the site were first observed in 1930. The property is privately owned. The site is approximately 20 ha (49 ac) in size. In 1994, the site contained more than 200 flowering plants. The plants were exceptionally vigorous and occurred throughout a large area, making this one of the best populations of *Arabis perstellata* in Kentucky.

**Unit 11. U.S. 127 in Franklin County, Kentucky**
Unit 11 is located along the east side of U.S. 127 in a ravine just southeast of Elkhorn Creek. The site is privately owned. This unit is approximately 11 ha (27 ac) in size. The plants were first observed in 2001, at which time approximately 100 plants were found on the west-facing slope. This population [#39, Unit 11] is now considered extirpated by KSNPC.



**Map 4 - Units 10 and 11: critical habitat for Braun's rock-cress in Kentucky.**



**Unit 12. Camp Pleasant Branch Woods in Franklin County, Kentucky**
Unit 12 is located along the south side of Camp Pleasant Road (KY Highway 1707). This site is privately owned and contains approximately 14 ha (35 ac). The first observance of plants at this site was in 1987. In 2001, over 100 plants were found along the lower northwest-facing slope. Plants at this site are threatened by competition from weeds.

**Unit 13. Saufley in Franklin County, Kentucky**
Unit 13 occurs west of the KY Highway 1900 bridge over Elkhorn Creek on the hillside above the creek. The land ownership for this unit is private. The site is approximately 8 ha (20 ac) in size. Plants were first observed in 1988. In 1996, more than 100 hundred plants were found along the top of the ridge on the northeast-facing slope.

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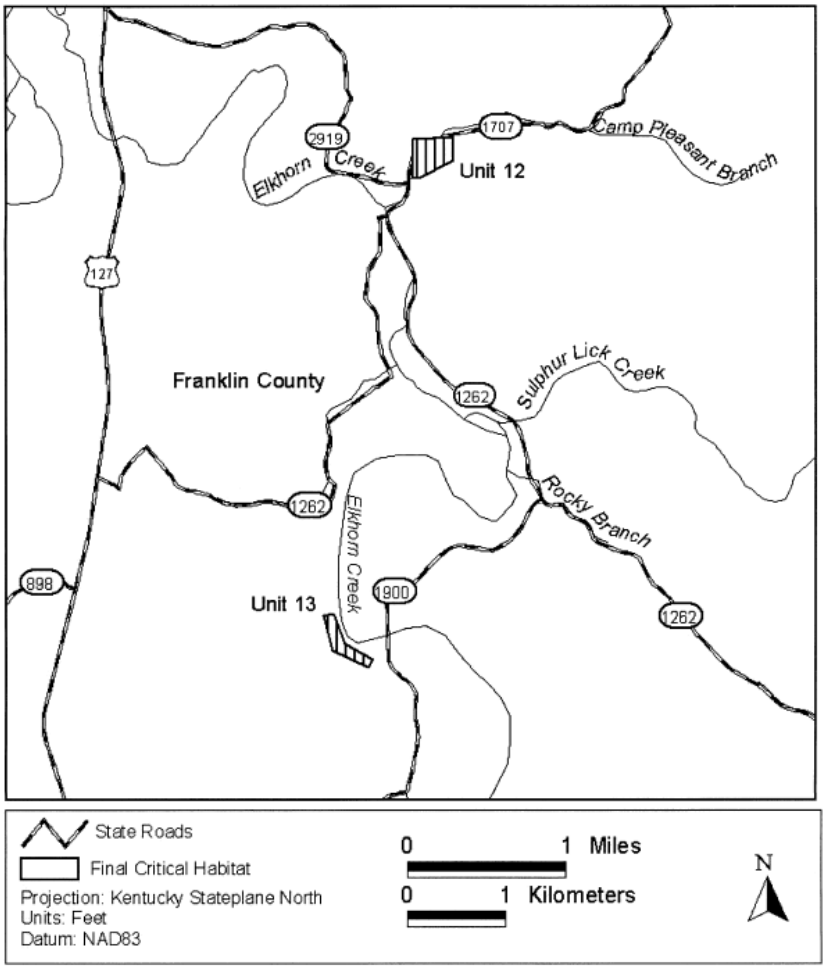
**Map 5 - Units 12 and 13: critical habitat for Braun's rock-cress in Kentucky.**



**Unit 14. Clements Bluff in Owen County, Kentucky**
This unit is located in a ravine facing the Kentucky River along the east side of KY Highway 355. The site is owned by the State of Kentucky and is part of the Kentucky River Wildlife Management Area. This unit is approximately 11 ha (27 ac) in size. The plants were first observed at this site in 1980 on the north-facing slope. In 1996, approximately 100 plants occurred at the site.

**Unit 15. Monterey U.S. 127 in Owen County, Kentucky**
Unit 15 is located 1.6 km (1 mile) north of the City of Monterey, just north of the junction of U.S. 127 and KY Highway 355. The property is privately owned. It is approximately 12 ha (30 ac) in size. Plants were first observed at this site in 1996. In 1997, 150 plants were found along the southwest-facing slop of an unnamed tributary to the Kentucky River. The site is being threatened by weedy competition.

**Unit 16. Craddock Bottom in Owen County, Kentucky**
This unit is located south of the City of Monterey. It occurs along the west side of Old Frankfort Pike on the west-facing slope just east of Craddock Bottom. Property at this site is privately owned. The site contains approximately 23 ha (57 ac). In 1996, over 150 plants were found. In 1996, there was evidence of logging in the surrounding area.

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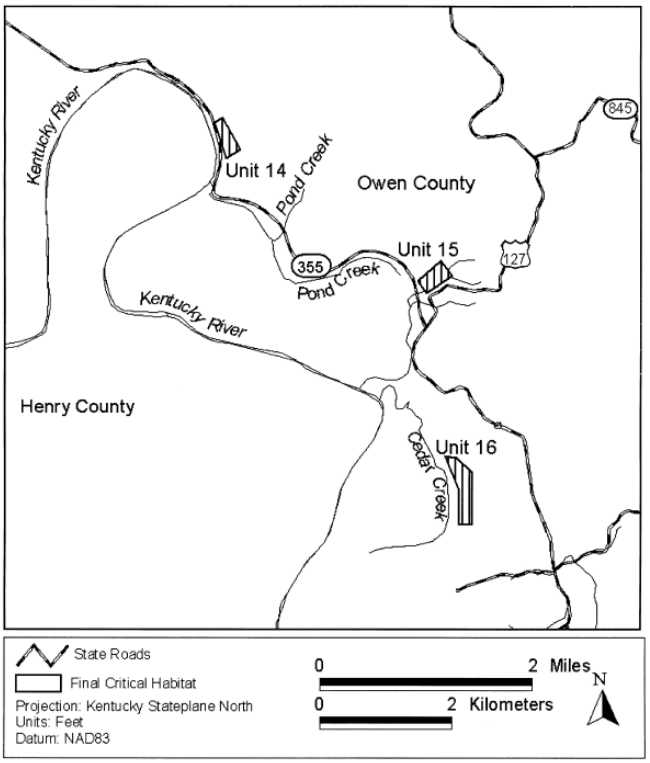
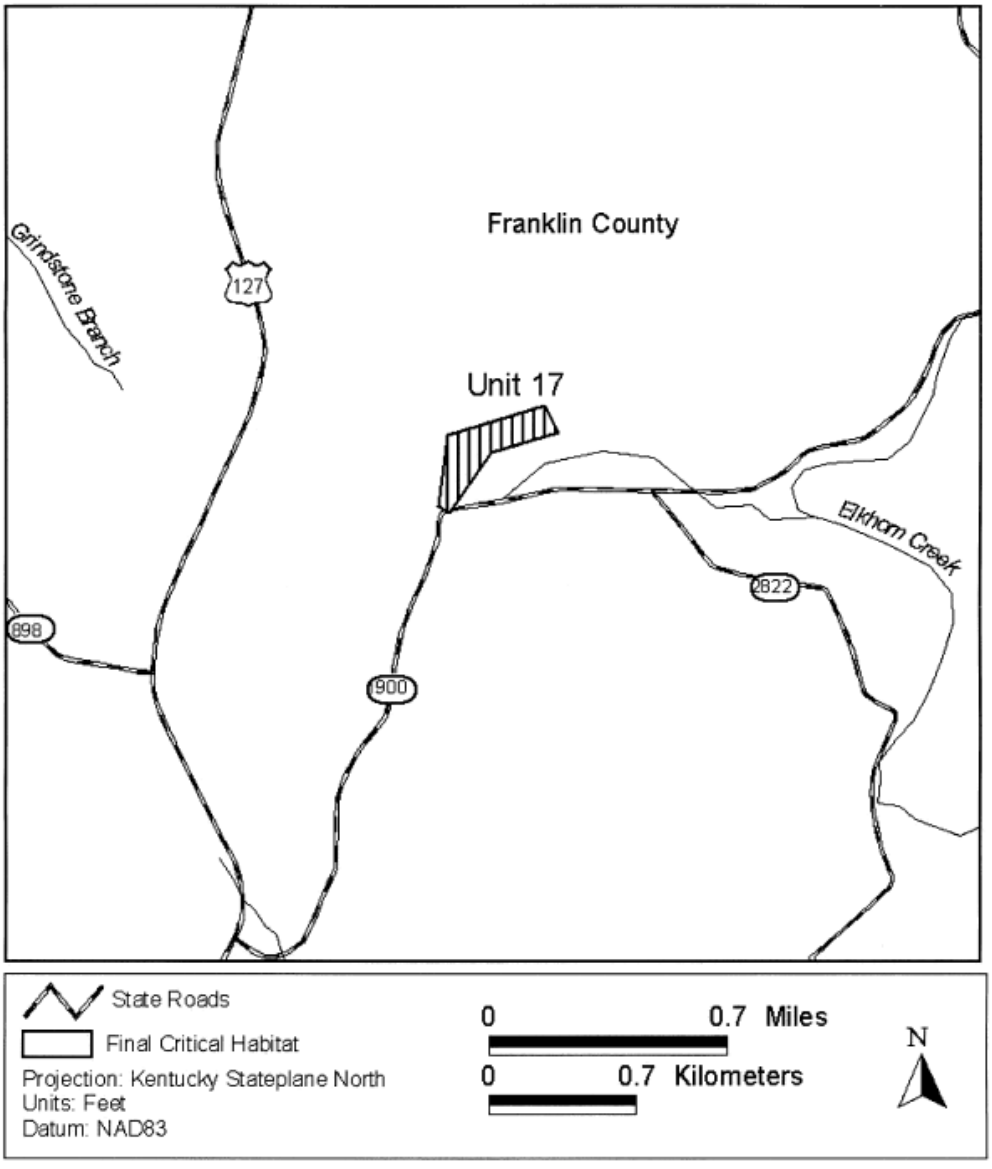
**Map 6 - Units 14, 15 and 16: critical habitat for Braun's rock-cress in Kentucky.**



**Unit 17. Backbone North in Franklin County, Kentucky**
Unit 17 is located north of KY Highway 1900. It occurs in an old river oxbow west of the existing Elkhorn Creek and is privately owned. The unit size is approximately 11 ha (27 ac). Plants were first observed at this site in 1981. In 1990, more than 200 plants were found on the southeast-facing slope.



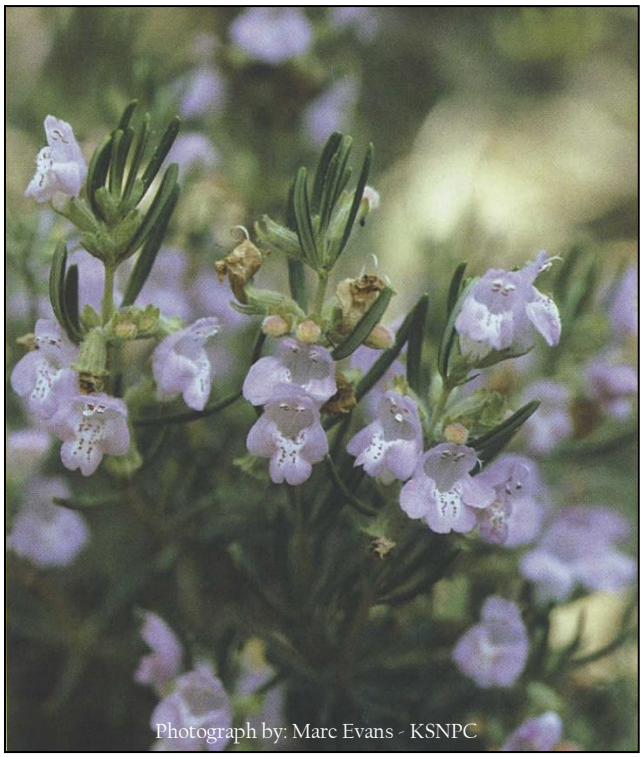
**Map 7 - Unit 17: critical habitat for Braun's rock-cress in Kentucky.**



# Cumberland Rosemary (*Conradina verticillata*)

AKA: Cumberland False Rosemary; Upland Rabbitbane

## Species Description




Cumberland rosemary (*Platanthera integrilabia*) was listed as an **endangered** species on November 29, 1991.

A member of the Mint family (*Lamiaceae*), Cumberland rosemary is a small evergreen, perennial shrub with small needle-like, whorled leaves. The leaves are noted for their aromatic scent (which smell like the culinary herb rosemary). The very narrow leaves are about 1 inch long and appear to be in whorls along the stems. Individual plants are about 1.5 feet high with reclining branches, which often take root where they touch the ground. This rooting at the nodes produces clones and an entire population of plants on a sandbar may be a single plant genetically.

Cumberland rosemary produces abundant small, pink to lavender colored flowers which are spotted inside with white. Flowers typically bloom from May to June. Pedestrian surveys should be conducted during this time in areas of favorable habitat.

No other plants are likely to be mistaken for it when it is in flower, usually from mid-May to early June. Without flowers, however, it resembles stiff aster (*Ionactis linariifolius*), bushy St. John's-wort (*Hypericum densiflorum*), or slender mountain mint (*Pycnanthemum tenuiflorum*), all which have needlelike leaves and grow in the same habitat but do not have the distinctive rosemary aroma.

A cultivated variety of Cumberland rosemary does exist and is used in yard landscaping; however, wild Cumberland rosemary cannot survive being transported from its natural habitat and thus has resulted in its endangered status.

## Habitat Description

This species grows in full to moderate sunlight in the floodplain of major streams flowing over sandstone. The substrate varies from expanses of deep, pure sand to densely rocky areas that are always well drained and devoid of organic matter. Essential habitat requirements for Cumberland rosemary include periodic flooding to maintain openness, micro-topographic features to enhance sand deposition, and periods of inundation of at least two weeks to induce rooting at the lower nodes of the stems.

River bank boulders and gravel bars

Although Cumberland rosemary tolerates extended periods of submersion and thrives in full sunlight, it seldom, if ever, grows directly beside the normal pool level, probably because of the soil saturation associated with the higher water table at these locations. With few exceptions, the only place where Cumberland rosemary is found in any abundance is on wide gravel/boulder point-bars of river bends, outwash bars, or low-


Treeless outwash gravel bar

Photo Credits: Third Rock Consultants, Lexington, KY

lying islands. Outwash bars and islands frequently occur downstream of where major tributaries enter the main channel, depositing sediments and widening the floodplain.

Specific areas supporting the species include: boulder bars, boulder/gravel bars, sand bars, terraces of sand on gradually sloping river banks and islands, and pockets of sand between large boulders on islands and stream banks.

The bars on which it is found tend to be dominated by grasses such as big bluestem (*Andropogon gerardii*), little bluestem (*Schizachyrium scoparium*), and Indian grass (*Sorgastrum nutans*). Associated flowering species are smooth phlox (*Phlox glaberrima*), wild indigo (*Baptisia tinctoria*), and Virginia goat's-rue (*Tephrosia virginiana*).


Flood scoured gravel bar on right, less scoured tree covered bar on left

Gravel bar exposed to full sun

Gravel bar (right side) with large boulders allowing sand deposition and protection from flooding forces

Large boulders on stream margins and boulder islands

Photo Credits: Third Rock Consultants, Lexington, KY

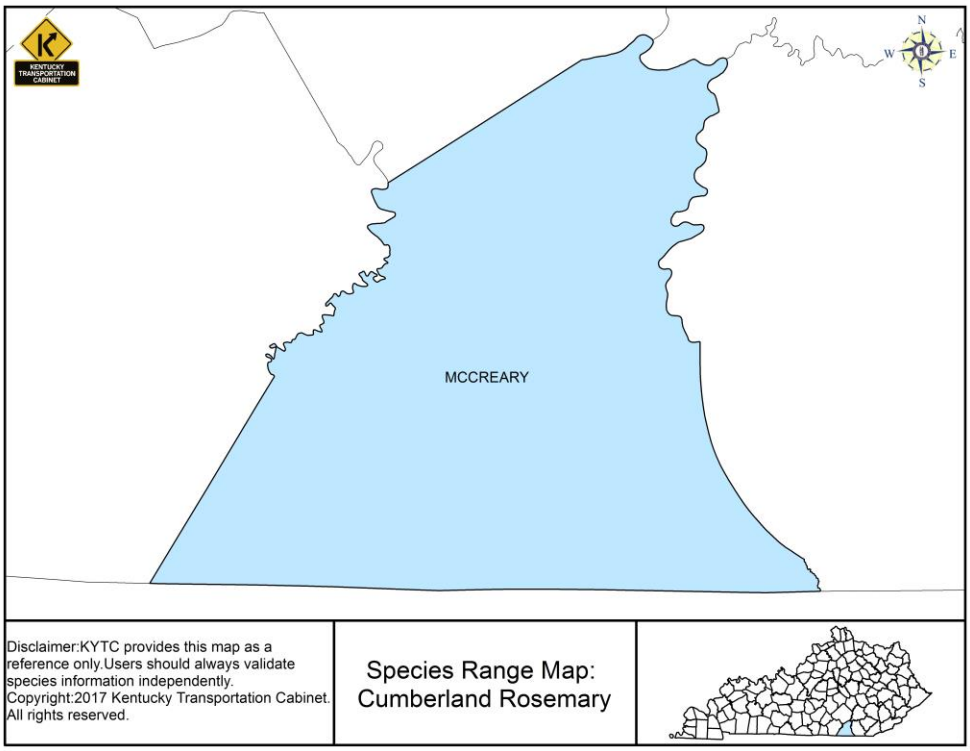
The most likely impacts associated with transportation projects are loss of habitat due to placement of bridge piers along stream banks and on small islands. New bridge piers, in-stream or near banks, could also alter the normal flow pattern and current velocity, causing erosion of downstream habitats. The removal or placement of boulders either in stream or on banks could alter or completely destroy existing habitat. An additional threat includes invasive exotic plants.

## Critical Habitat

None

## Range

Cumberland rosemary is known from five counties in north-central Tennessee and one county in southeastern Kentucky. At present, 91 occurrences (colonies) are thought to be extant. In Kentucky there are 12 known occurrences, all on the Big South Fork of the Cumberland River and within the Big South Fork National River and Recreation Area in McCreary County. Currently, this species is listed for in only this single county in Kentucky.



## Decision Key

1) Will any part of the project impact the Big South Fork of the Cumberland River (south of KY 92)?

    a. Yes: Contact SME
    b. No: Prepare NE finding

## Literature Cited

Patrick, T.S. and B.E. Wofford. 1981. Status Report *Conradina verticillata* Jennison. Unpublished report to the Southeast Region US Fish and Wildlife Service. 49 pp.

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U.S. Fish and Wildlife Service. 2011. Cumberland Rosemary (Conradina verticillata). 5-Year Review: Summary and Evaluation. Southeast Region. Tennessee Ecological Services Field Office. Cookeville, TN.

# Cumberland Sandwort (*Minuartia cumberlandensis*)

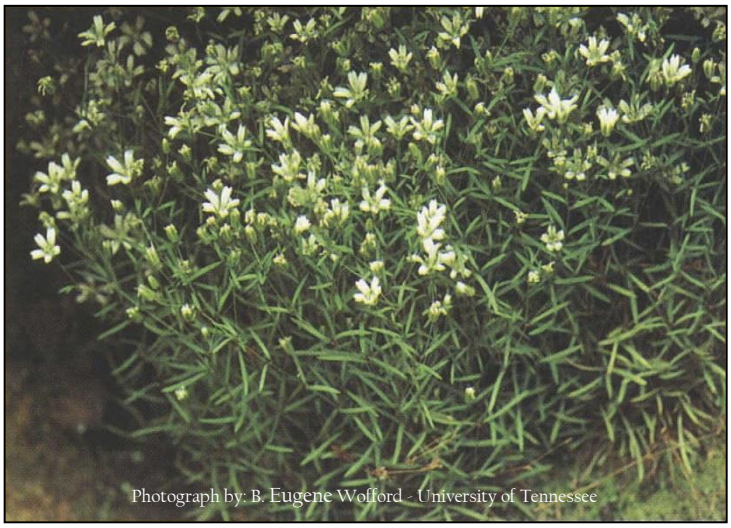
AKA: *Arenaria cumberlandensis*

## Species Description

Photo Courtesy of http://www.nps.gov

Cumberland sandwort (*Minuartia cumberlandensis*) was listed as **endangered** on June 23, 1988. Additionally, the December 2013 U.S. Fish and Wildlife 5-Year Review suggests that Cumberland sandwort has met criteria that make it eligible for reclassification as threatened.

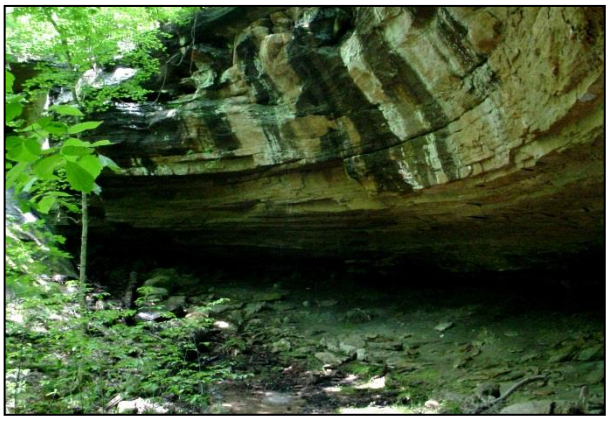
A member of the Pink (or Carnation) family (*Caryophyllaceae*), Cumberland sandwort is a terrestrial, perennial herb 10-15 cm (4-6 inches) tall. It has wiry, angular stems and its leaves are relatively long and narrow. Cumberland sandwort produces small, white-petaled flowers.




Cumberland sandwort can be easily confused with glabrous mountain sandwort (*Minuartia glabra*), since both occur in somewhat similar habitat. Cumberland sandwort has longer broader, thinner, and veinier leaves, leafier upper stems, produces fewer flowers, and has a distinctive seed sculpture. Cumberland sandwort begins flowering in late June or early July, while the glabrous mountain sandwort flowers in April and early May. This diminutive species can easily be overlooked on high ledges within large rock-shelters (shallow cave-like areas that have been created by under-cutting along a cliff-line). It can be recognized from May through late summer but is mostly easily recognized when flowering.

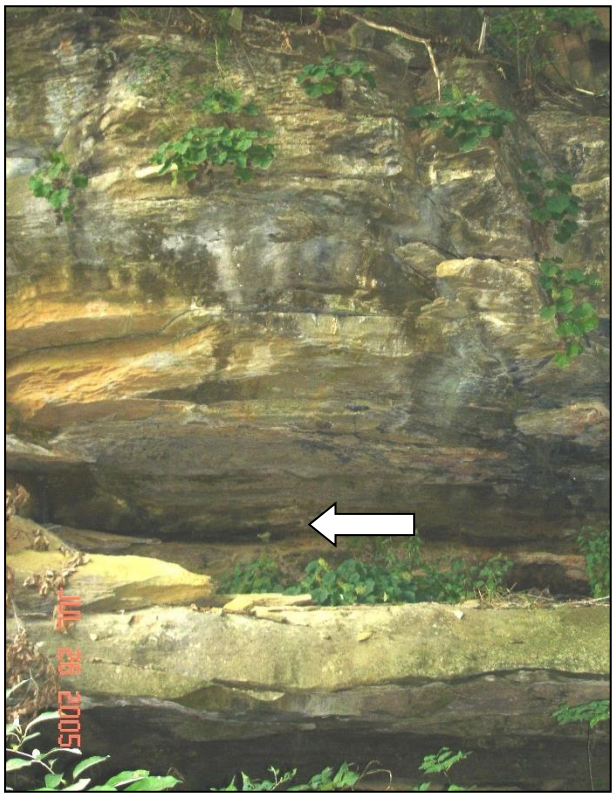
## Habitat Description

The Cumberland sandwort is found in damp soils on the sandy floors of cool, humid rock-houses, in solution pockets on the face of shaded sandstone cliffs, and on rock ledges beneath overhanging sandstone. This species occurs where the correct combination of shade, high moisture and humidity, and cool temperatures provides the appropriate micro-habitat conditions. The plant occurs only where it is sheltered from direct sunlight and direct rainfall.



Rockshelter with moisture and indirect sunlight

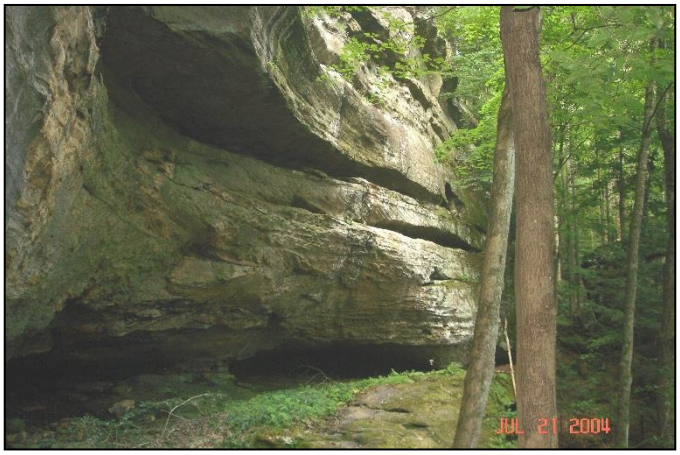
There is generally good correlation between the occurrence of the Cumberland sandwort and the distribution of the Rockcastle Conglomerate. The Rockcastle conglomerate is a member of the Lee Formation. The occurrences of Cumberland sandwort that do not occur on Rockcastle Conglomerate are found on sandstones of the Breathitt or Lee Formations.




Cliff face with solution pockets (cliff face indicated by arrow)
Photo Credits: Third Rock Consultants, Lexington, KY

Significant threats to plants growing on rock-house floors include: trampling by hikers, campers, and picnickers, and illegal digging for artifacts. Plants growing on ledges and in solution pockets on cliff faces are vulnerable to trampling by people rappelling down cliffs. Timber removal in or adjacent to sites supporting this species can result in increased sunlight and

the subsequent alteration of the moisture conditions necessary for the Cumberland sandwort. The most likely impacts associated with transportation projects are from land clearing or selected tree removal. The removal of trees near cliff-lines or in front of rock-houses and the resulting loss of shade would increase sunlight and subsequently alter the requisite moisture conditions.




Rock shelter with moist soils and filtered (indirect) sunlight
Photo Credit: Third Rock Consultants, Lexington, KY

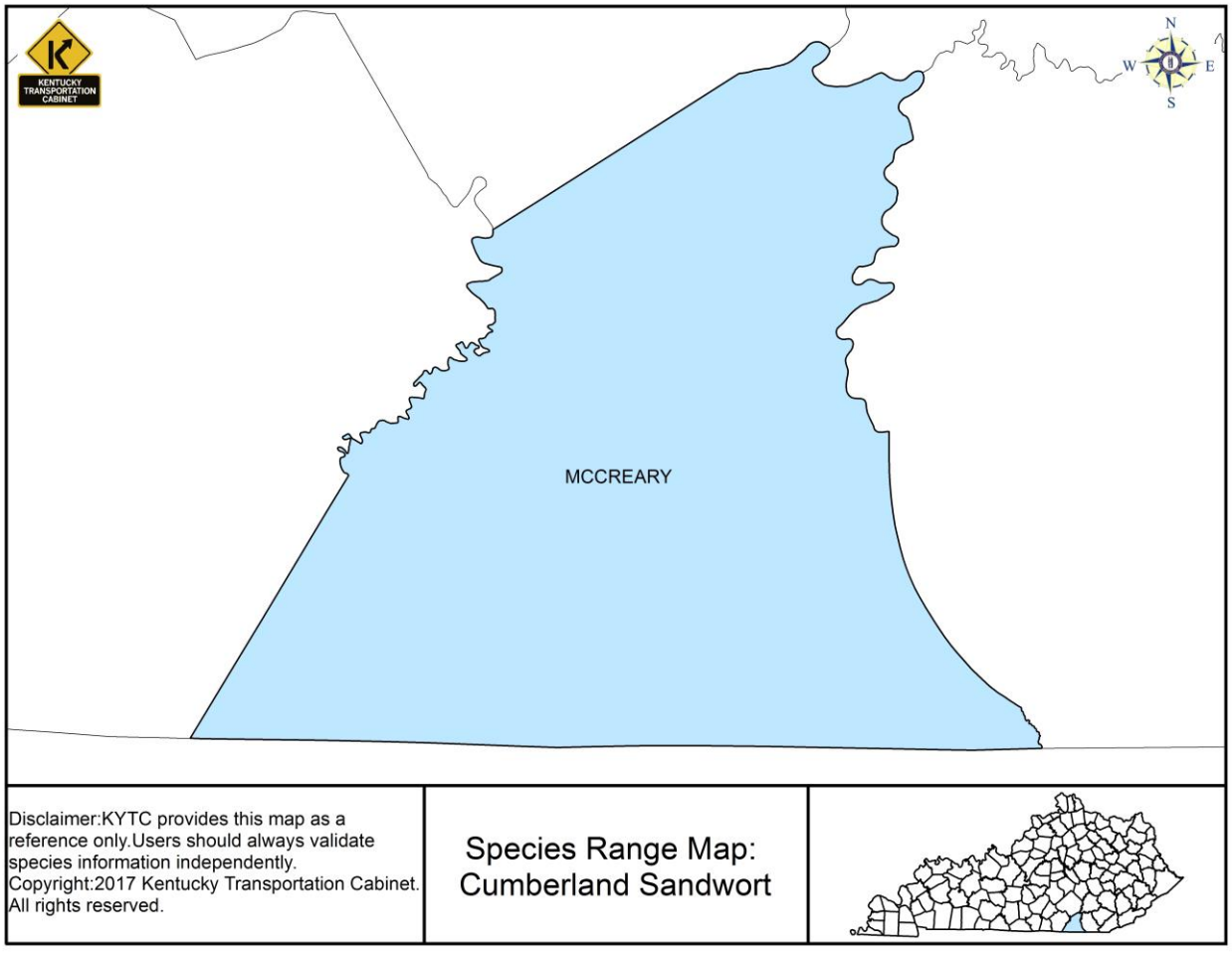
## Critical Habitat

None

## Range

Cumberland sandwort is currently known from four counties in Tennessee (Pickett, Scott, Fentress, and Morgan) and one county in Kentucky (McCreary). There are currently 27 known occurrences in Tennessee and one in Kentucky. The majority of these occurrences are within close proximity of each other; 20 of the 27 are within 2 miles of each other and all of the sites occur within 25 miles of each other.

The known Kentucky occurrence is within the Big South Fork National River and Recreation Area, approximately one mile north of the Tennessee state line. A second population, found by Max Medley in 1984, was located west of the recreation area along Rock Creek, but has not been relocated since. Currently, this species is listed for a single county in Kentucky.



## Decision Key

*Office Assessment*:

1) Is the project located on or immediately adjacent to the Rockcastle conglomerate, Breathitt or Lee formations where topographic maps indicate the possibility of clifflines and rock-houses?

    a. Yes: Continue to Step 2
    b. No: Prepare NE finding

*Field Assessment:*

2) Are there any shaded cliffs or rock houses found in or adjacent to the project area?

    a. Yes: Contact SME
    b. No: Prepare NE finding

## Literature Cited

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Wofford, B.E., and D.K. Smith. 1980. Status report on *Arenaria cumberlandensis*. Unpublished report prepared under contract to the Southeastern Region, US Fish and Wildlife Service. 22 pp

# Kentucky glade cress (*Leavenworthia exigua* var. *laciniata*)

## Species Description


Photo Credit: Thomas Barnes, University of Kentucky

On June 5, 2014, the U.S. Fish and Wildlife Service formally listed Kentucky glade cress as a **threatened** species and designated critical habitat for the species within two Kentucky counties.

This plant is about 2-4 inches in height. Small white to lilac colored flowers with four petals appear usually beginning in mid to late March. The fruit are flat and pod-shaped. The leaves are somewhat square at the end and appear as disconnected pieces along the main leaf vein. The leaves may be mostly gone when the plant is in fruit.

## Habitat Description

Kentucky glade cress is shade intolerant and grows on areas of flat soil, usually the thin soils and gravel around the dolomite rock outcrops. It is typically found in cedar or limestone glades. It is also found in lawns and pastures where moist bare soil is predominant in the spring. Some populations have also been observed in gravel driveways. Kentucky State Nature Preserve Commission developed a model to identify areas with potential habitat for this species. Mapping of this KSNPC modeling is provided at the end of the discussion of this species.

The natural rock outcrops in areas with thin soils are another important habitat for glade cress. The surface dolomitic limestone has created unusual conditions for plant growth, generally wet in the spring when water is held near the surface and then very dry due to the lack of soil and other vegetation throughout the summer. Glade cress takes advantage of this moist spring by flowering in March and dispersing its seed in May and June, before other plants can establish. However, agricultural crops and even lawns have done poorly where rock is near the soil surface and in many areas it has been broken up and removed.

## Critical Habitat

Yes (*See more detailed information and maps provided after decision key*)

In 2014, the USFWS designated 6 units, consisting of 18 subunits, (total of 2,053 acres) as critical habitat in Jefferson and Bullitt Counties, KY.

Primary Constituents Elements:

1) Cedar glades and gladelike areas within the range of *L. exigua* var. *laciniata* that include:
   a) Areas of rock outcrop, gravel, flagstone of Silurian dolomite or dolomitic limestone, and/or shallow (1 to 5 cm (0.393 to 1.97 in)), calcareous soils;
   b) Intact cyclic hydrologic regime involving saturation and/or inundation of the area in winter and early spring, then drying quickly in the summer;
   c) Full or nearly full sunlight; and
   d) An undisturbed seed bank.
2) Vegetated land around glades and gladelike areas that extends up and down slope and ends at natural (e.g., stream, topographic contours) or manmade breaks (e.g., roads).

| Critical habitat unit | Sub unit | Land ownership by type | Acres | Hectares |
|---|---|---|---|---|
| 1 | --------- | Louisville/Jefferson County Metro Government | 18 | 7 |
| 2 | 2A | Private | 102 | 41 |
| 2 | 2B | Private | 870 | 352 |
| 2 | 2C | Private | 42 | 17 |
| 3 | 3A | Private | 25 | 10 |
| 3 | 3B | Private | 7 | 3 |
| 3 | 3C | Private | 10 | 4 |
| 4 | 4A | Private | 91 | 37 |
| 4 | 4B | KSNPC; Private; Private with KSNPC easement | 69 | 28 |
| 4 | 4C | Private | 83 | 34 |
| 4 | 4D | Private | 46 | 19 |
| 4 | 4E | Private | 102 | 41 |
| 4 | 4F | Private | 120 | 49 |
| 4 | 4G | Private | 20 | 8 |
| 4 | 4H | Private | 16 | 6 |
| 5 | 5A | Private | 8 | 3 |
| 5 | 5B | Private | 50 | 20 |
| 6 | --------- | Private | 374 | 151 |
| **Total** | --------- | --------- | **2,053** | **830** |

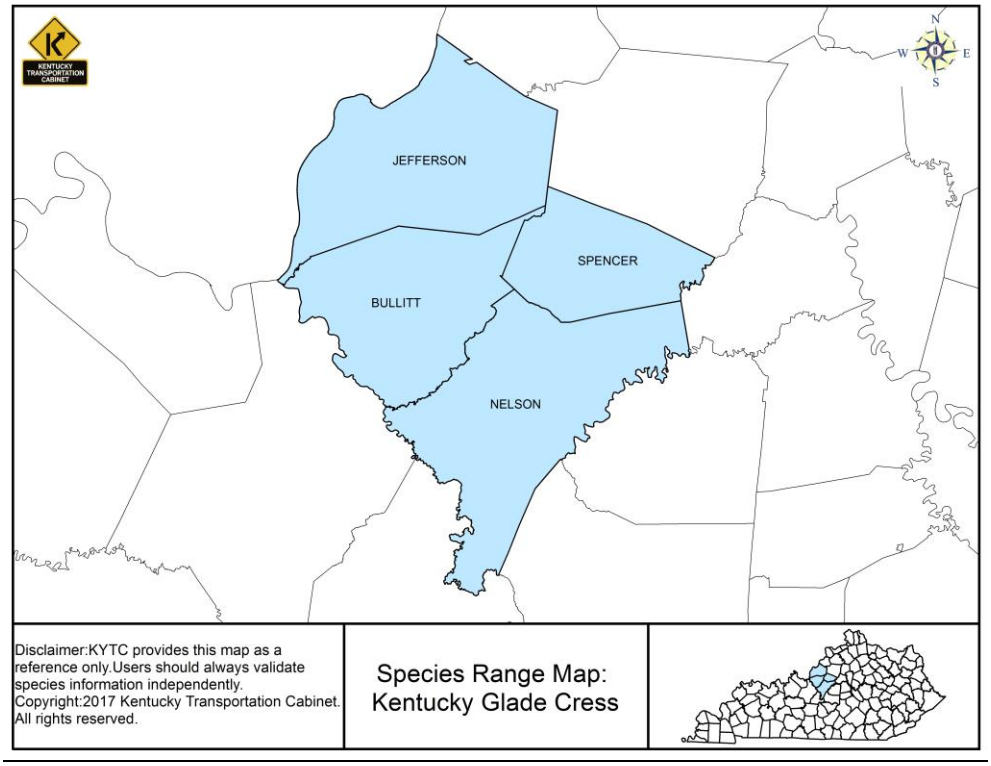
*Table data provided within Federal Register Vol. 79 No. 87; Tuesday, May 6, 2014; Rules and Regulations.

## Range

Kentucky glade cress is currently listed for Bullitt, Jefferson, Nelson, and Spencer Counties.

All known populations and critical habitat units occur in Bullitt and Jefferson Counties only.

There are no current population records within Spencer or Nelson Counties.




## Decision Key

1) Does the project area occur within ¼ mile of a critical habitat unit, in cedar glades, or have areas with thin, rocky soil underlain by limestone (refer to county soil survey map and attached habitat modeling map)?

    a. Contact SME
    b. No: Prepare NE finding

## Literature Cited

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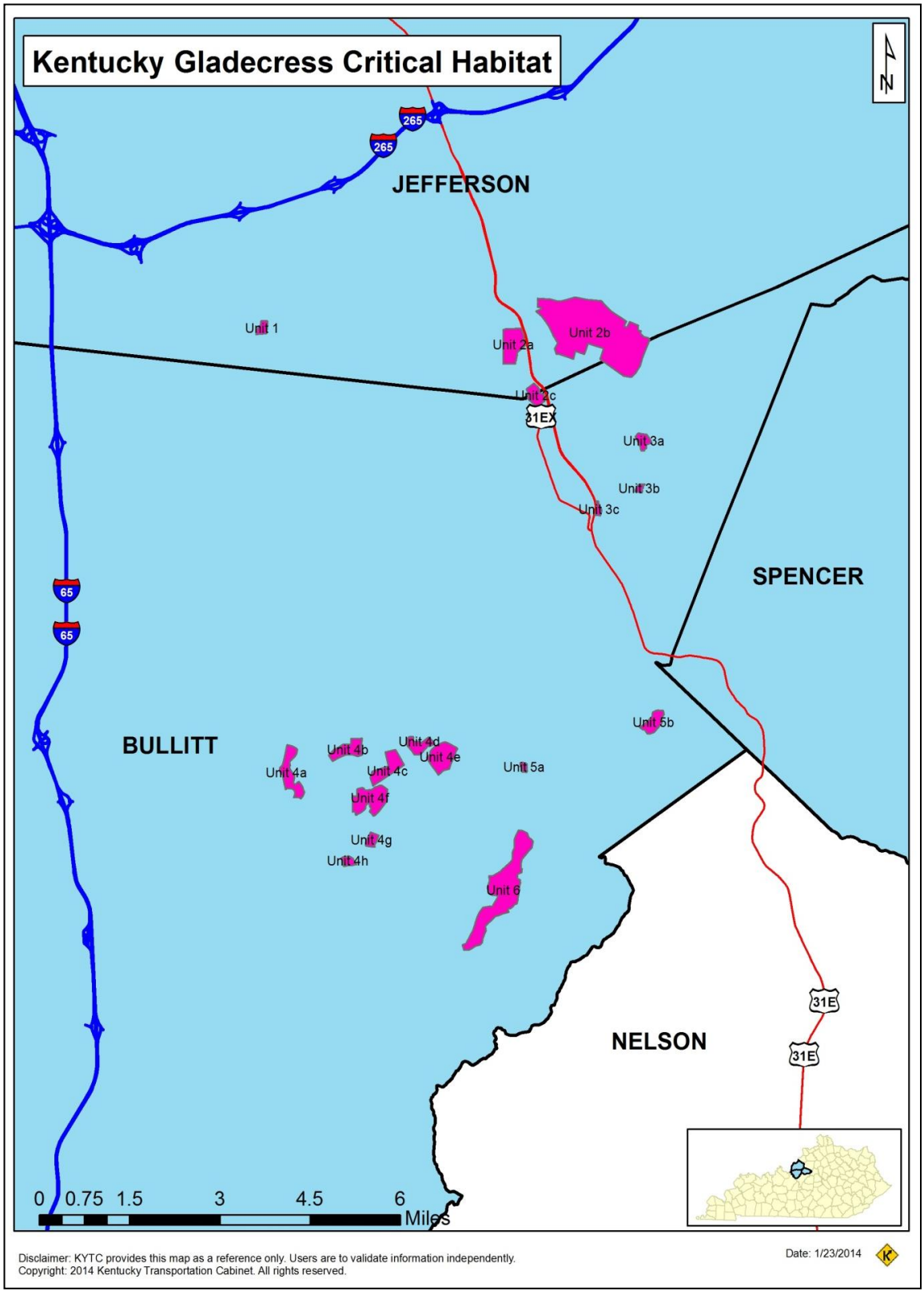
U.S. Fish and Wildlife Service. 2013, Endangered and Threatened Wildlife and Plants; Proposed Threatened Status for *Leavenworthia exigua var. laciniata* (Kentucky glade cress).

Designated Critical Habitat



## Designated Critical Habitat

**Unit 1. McNeely Lake, Jefferson County, Kentucky**
Unit 1 consists of 18 acres (ac) (7 hectares (ha)) within McNeely Lake Park in Jefferson County, Kentucky. This critical habitat unit is under county government ownership. This critical habitat unit occurs at the northwestern edge of the species' range, where there is little remaining habitat and few occurrences, and therefore this unit is important to the distribution of the species. Habitat degradation (e.g., erosion, invasive species) is impacting the species' ability to persist within this unit; however, the landowner has received funding and is working with the Service and KSNPC to develop a management plan for the site and to implement habitat improvement practices. These planned activities are expected to improve population numbers and viability at this important site. This unit helps to maintain the geographical range of the species and provides opportunity for population growth. Within Unit 1, the features essential to the conservation of the species may require special management considerations or protection to address potential adverse effects associated with encroachment by nonnative plants or forage species, and forest encroachment due to fire suppression.

**Unit 2. Subunits A, B, and C: Old Mans Run, Jefferson and Bullitt Counties, Kentucky**
Unit 2 consists of three subunits totaling 1,014 ac (410 ha) in Bullitt and Jefferson Counties, Kentucky. It is located just south of the Jefferson/Bullitt County line and extends north of Old Mans Run. This critical habitat unit includes for element occurrences. Subunit 2B represents the best remaining populations and habitat for *L. exigua* var. *laciniata* in Jefferson County. Subunits 2A and 2C are important areas at the northern extent of the species' range. These three subunits represent the northeastern extent of the population's range and increase population redundancy within the species' range. The features essential to the conservation of the species in Unit 2 may require special management considerations or protection to address potential adverse effects associated with development on private land, incompatible agricultural or grazing practices, ORV or horseback riding, competition from lawn grasses, and forest encroachment.

Subunit 2A is 102 ac (41 ha) in size and is located west of US 150 and northwest of Floyds Fork. It is in private ownership. While all PCEs are present within this subunit, it contains few native plant associates for *L. exigua* var. *laciniata*, and the increased competition from lawn grasses may decrease the ability of *L. exigua* var. *laciniata* to persist. This subunit is important for maintaining the northern distribution of *L. exigua* var. *laciniata*.

Subunit 2B is 870 ac (352 ha) in size and is located east of US 150 and extends north and south of Old Mans Run. It is in private ownership. This is the largest of the subunits and contains the two highest ranked (1-B and 1-C) occurrences in Jefferson County. It represents the best remaining habitat in this portion of the range and may contain more than 20,000 individuals at 4 sites within this subunit. In this subunit, competition from lawn grasses impacts *L. exigua* var. *laciniata* and may decreased the plant's ability to persist.

Subunit 2C is 42 ac (17 ha) in size and is located west of US 150 and east of Floyds Fork, extending into both Bullitt and Jefferson Counties. It is in private ownership. This subunit is primarily pasture, and habitat for *L. exigua* var. *laciniata* is impacted by competition from lawn grasses. Habitat management within this subunit to improve habitat for *L. exigua* var. *laciniata* is important for maintaining the northern distribution of the species.

**Unit 3. Subunits A, B, and C: Mount Washington, Bullitt County, Kentucky**
Unit 3 consists of 42 ac (17 ha) and includes three subunits in Bullitt County, Kentucky, primarily within or adjacent to the city limits of Mount Washington. This critical habitat unit includes three element occurrences and provides an important link between the northern and southern portions of the species' range. Within Unit 3, the features essential to the conservation of the species may require special management considerations or protection to address potential adverse effects associated with development on private land, incompatible agricultural or grazing practices, ORV or horseback riding, competition from lawn grasses, and forest encroachment due to fire suppression.

Subunit 3A is 25 ac (10 ha) in size and is located northeast of Mount Washington. It is in private ownership. Habitat for *L. exigua* var. *laciniata* within this subunit is degraded and would improve with management. It represents important habitat on the eastern extent of the species' range. In this subunit, habitat conversion and ORV use impact *L. exigua* var. *laciniata* habitat and may decrease the species' ability to persist at this site.

Subunit 3B is 7 ac (3 ha) in size and located east of Hubbard Lane and south of Keeneland Drive. It is in private ownership. The glade habitat has been degraded by adjacent land use and would benefit from improved management. The subunit represents an important link between other subunits.

Subunit 3C is 10 ac (4 ha) in size and is located east of US 150 and south of Highway 44E. It is in private ownership. The subunit represents an important and high quality cedar glade in an area of ongoing, intensive development. Land use surrounding the glade remnant appears stable and the glade contains several native plant species associated with *L. exigua* var. *laciniata*.

**Unit 4. Subunits A, B, C, D, E, F, G, and H: Cedar Creek, Bullitt County, Kentucky**
Unit 4 consists of 547 ac (221 ha) and includes eight subunits, all in Bullitt County, Kentucky. This unit is located south of the Salt River and northeast of Cedar Grove and seems to represent the core of the remaining high-quality habitat for *L. exigua* var. *laciniata*. It includes eight element occurrences. In addition to being a stronghold for the species, these subunits are generally within close proximity (less than 0.5 miles (0.8 km)) to each other and represent the best opportunity for genetic exchange between occurrences.

With Unit 4, the features essential to the conservation of the species may require special management considerations or protection to address potential adverse effects associated with development on private land, incompatible agricultural or grazing practices, ORV and horseback riding, competition from lawn grasses, and forest encroachment due to fire suppression.

Subunit 4A is 91 ac (37 ha) in size and is located south of Cedar Creek and west of Pine Creek Trail. This subunit is owned by The Nature Conservancy and encompasses most of the Pine Creek Barren Preserve. This excellent-quality glade represents the only remaining "A" rank occurrence for *L. exigua* var. *laciniata*.

Subunit 4B is 69 ac (28 ha) in size and is located along an unnamed tributary to Cedar Creek, and south of KY 1442. This good-quality glade includes the Apple Valley Glade State Nature Preserve, owned by KSNPC (approximately 30 percent of subunit) as well as private land, including some under permanent conservation easement (approximately 41 percent of subunit) to protect *L. exigua* var. *laciniata*. Approximately 29 percent of this subunit is under private ownership without any protections for *L. exigua* var. *laciniata*.

***(Unit 4 continued)***

Subunit 4C is 83 ac (34 ha) in size and located north of Cedar Creek and south of Apple Valley State Nature Preserve. It is in private ownership. This subunit contains high-quality glades with a community of native plants present.

Subunit 4D is 46 ac (19 ha) in size and is located north of Cedar Creek and south of Victory Church. It is in private ownership. This subunit has been degraded and would benefit from improved management. Native plants associated with *L. exigua* var. *laciniata* occur within this subunit, but competition from lawn grasses, as well as forest encroachment due to fire suppression, impacts *L. exigua* var. *laciniata* and may decrease its ability to persist.

Subunit 4E is 102 ac (41 ha) in size and is located southeast of subunit 4D and across Cedar Creek. It is in private ownership. It contains a large number of *L. exigua* var. *laciniata* (several thousand), but the habitat has been degraded by adjacent land use and would benefit from improved management. Competition from lawn grasses, as well as forest encroachment die to fire suppression, affects *L. exigua* var. *laciniata* and may decrease the plant's ability to persist.

Subunit 4F is 120 ac (49 ha) in size and is south of the confluence of Cedar Creek and Greens Branch. It is in private ownership. This is a degraded glade that still contains native plants associated with *L. exigua* var. *laciniata*. The subunit is disturbed by existing and surrounding land uses, as well as utility line maintenance and ORV use, which may decrease the species' ability to persist.

Subunit 4G is 20 ac (8 ha) in size and is located along either side of KY 480 near White Run Road. It is in private ownership. This site contains a large number of plants; however, improved habitat conditions are needed for long-term viability of the *L. exigua* var. *laciniata* occurrence. Impacts to *L. exigua* var. *laciniata*, which may decrease its ability to persist at the site, include incompatible agricultural or grazing practices, ORV use, competition from lawn grasses, and forest encroachment due to fire suppression.

Subunit 4H is 16 ac (6 ha) in size and is located 0.95 miles southeast of the KY 480/KY 1604 intersection. It is in private ownership. Within this subunit, several patches of good habitat for *L. exigua* var. *laciniata* remain as well as a good diversity of native plant associates. However, competition from lawn grasses, as well as forest encroachment due to fire suppression, affects L. exigua var. laciniata and may decrease its ability to persist.

**Unit 5. Subunits A and B: Cox Creek, Bullitt County, Kentucky**

Unit 5 consists of 58 ac (23 ha) and includes two subunits, both in Bullitt County, Kentucky. It includes two element occurrences, representing the most easterly occurrences south of the Salt River. These subunits are important for maintaining the distribution and genetic diversity of the species. With Unit 5, the features essential the conservation of the species may require special management considerations or protection to address potential adverse effects associated with illegal waste dumps, development on private land, incompatible agricultural and grazing practices, ORV or horseback riding, competition from lawn grasses, and forest encroachment due to fire suppression.

Subunit 5A is 8 ac (3 ha) in size and is located east of Cox Creek and west of KY 1442. It is in private ownership. This site is threatened by ORV use and would benefit from improved habitat management.

***(Unit 5 continued)***

Subunit 5B is 50 ac (20 ha) in size and is located west of Cox Creek near the Bullitt/Spencer County line. It is in private ownership. Incompatible agricultural practices and ORV use impacts *L. exigua* var. *laciniata* and may decrease its ability to persist. The native flora is mostly intact, and *L. exigua* var. *laciniata* would benefit from improved habitat management.

**Unit 6. Rocky Run, Bullitt County, Kentucky**

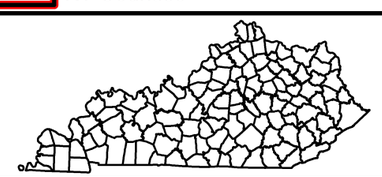
Unit 6 consists of 374 ac (151 ha) in Bullitt County, Kentucky. This critical habitat unit includes habitat that is under private ownership, including one 16-acre registered natural area. It includes one element occurrence. This unit appears to represent the largest intact glade habitat remaining within the range of the species. Within Unit 6, the features essential to the conservation of the species may require special management considerations or protection to address potential adverse effects associated with development on private land, incompatible agricultural or grazing practices, competition from lawn grasses, and forest encroachment due to fire suppression.

# KSNPC Model of Potential Habitat for KY Glade Cress



## Legend

- KY Glade Cress Potential Habitat
- KY Counties



# Price's Potato Bean (*Apios priceana*)

AKA: Ground nut; Price's ground nut; Traveler's Delight

Long pods and leaves of Price's Potato Bean.
Photo by Kimberlie McCue

## Species Description

Price's potato bean (*Apios priceana*) was listed as **threatened** on January 5, 1990.

A member of the Pea family (*Fabaceae*), price's potato bean is a herbaceous, perennial vine legume that grows from a single, large tuber (5 to 7 inches in diameter). Although the dispersal mechanism of Price's potato bean have not been studied, common groundnut (*Apios americana*) is frequently found near streams and produces many small tubers that are dispersed by water. It is relatively unknown whether tubers and seeds of Price's potato bean may be dispersed by water as well.


Plants of Price's potato bean are dicots that do not flower during their first year, but may grow as much as 5 to 6 feet in their first season. Observations also indicate that the tuber can remain dormant during one growing season yet still show vigorous growth the following year. Price's potato bean is most easily recognized when blooming, usually from mid-July through mid-August. Pedestrian surveys should be conducted during this time in areas of favorable habitat.

The flowers have a distinctive thick appendage at the apex of its standard (the usually large, upper petal of a papilionaceous (pea-like) flower). The species does not flower every year and is difficult to identify without its flowers; therefore, populations may have gone unrecognized in their vegetative state.

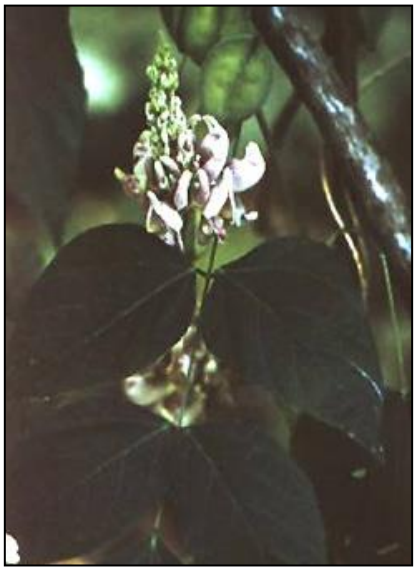


Photo Courtesy of http://www.fws.org

## Habitat Description

The species is often found in low open, woods near streams or along the transition area from floodplain to hillside. It will grow in second growth timber as well as in older, more mature forest. Price's potato-bean thrives in open woods (often in tree gaps or along forest edges associated with power lines or roadside rights-of-way) and will not tolerate heavy shade. The species may also be found near the base of small limestone bluffs. This species grows in well-drained calcareous loams or alluvium over limestone on floodplains or on open, rocky, wooded slopes. The species can survive a broad range of pH from less than five to greater than eight.

There are a number of woody and herbaceous species that are commonly found associated with Price's potato bean including: cane (*Arundinaria gigantea*), hog peanut (*Amphicarpa bracteata*), tall bellflower (*Campanula americana*), poison ivy (*Toxicodendron radicans*),


Wooded rocky slopes near a stream. The colluvial material at the base of the slope is potential habitat.

At the base of wooded rock ledges is habitat for this species.

Powerline right-of-way habitat

Photo Credits: Third Rock Consultants, Lexington, KY

redbud (*Cercis canadensis*), spicebush (*Lindera benzion*), chestnut oak (*Quercus muhlenbergii*), basswood (*Tilia americana*), sugar maple (*Acer saccharum*), and slippery elm (*Ulmus americana*).

New corridor construction in wooded areas, widening that requires tree clearing, bridge replacements that require altering floodplain habitats or selective tree removal, disturbance of borders of power line corridors, and borrow or fill areas that are located in partially wooded or open wooded areas prior to use, are all activities that could impact Price's potato-bean. Opening up the forest canopy during the growing season, which exposes the plant to increased direct sunlight, has been shown to damage the plant. Canopy thinning during the dormant season does not have a similar damaging effect.

Stream terrace in open woods

Habitat for this species can be found along powerline rights-of-ways along floodplains.

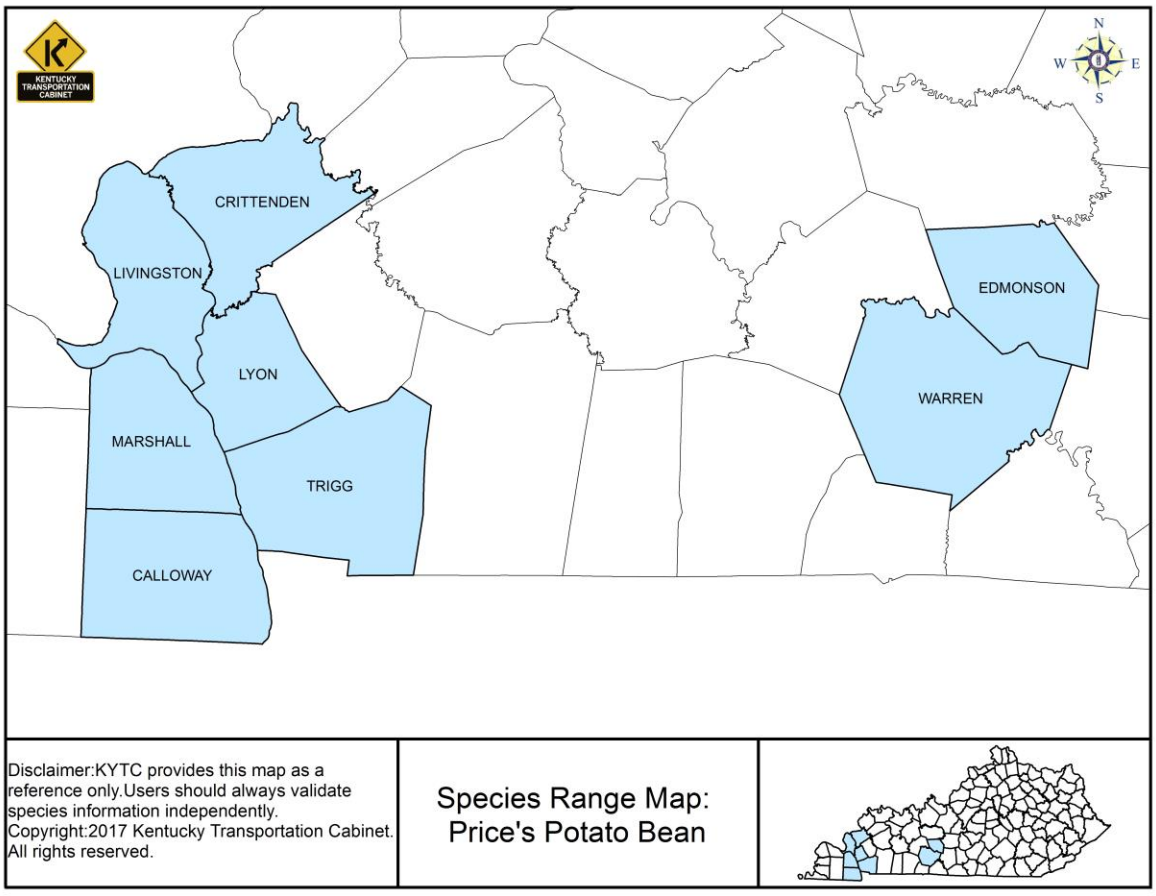
Photo Credit: Third Rock Consultants, Lexington, KY

## Critical Habitat

None

## Range

Sadie Price discovered this species in Warren County, Kentucky in 1896, and B.L. Robinson published its description in 1898, but the Warren County population has not been seen since 1920. Since its discovery, 36 populations of Price's potato bean have been found in 22 counties of five states: Alabama, Illinois, Kentucky, Mississippi, and Tennessee. Twenty-five populations are still extant in 15 counties of four states; eleven are thought to be extirpated, including the only two populations in Illinois. Price's potato-bean is found or has been found within the Interior Plateau, and Southwestern Appalachian Plateau Level 3 ecoregions. Kentucky's extant populations are closely identified with the Western Highland Rim Level 4 ecoregion (within the larger Interior Plateau level 3 ecoregion) and are found in Livingston, Lyon and Trigg counties. Price's potato bean also occurs in Stewart and Montgomery counties in Tennessee, counties adjacent to Trigg and Christian County, Kentucky. Currently, this species is listed for 8 counties in Kentucky.



## Decision Key

*Office Assessment*:

1) Are there soils underlain by limestone in a floodplain area?

    a. Yes: Continue to Step 2
    b. No: Prepare NE finding

*Field Assessment*:

2) Are there wooded hillsides, wooded limestone bluffs, or wooded floodplains along the banks of streams or rivers in the project area?

    a. Yes: Contact SME
    b. No: Prepare NE finding

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Walter, W.M., E.M. Croon, Jr., G.L. Catignani and W.C. Thresher. 1986 Compositional study of *Apios priceana* tubers. Journal of Agriculture and Food Chemistry 34: 39-41.

Woods, A.J., Omernik, J.M., Martin, W.H., Pond, G.J., Andrews, W.M., Call, S.M., Comstock, J.A., and Taylor, D.D. 2002. Ecoregions of Kentucky. Reston, VA. USGS.

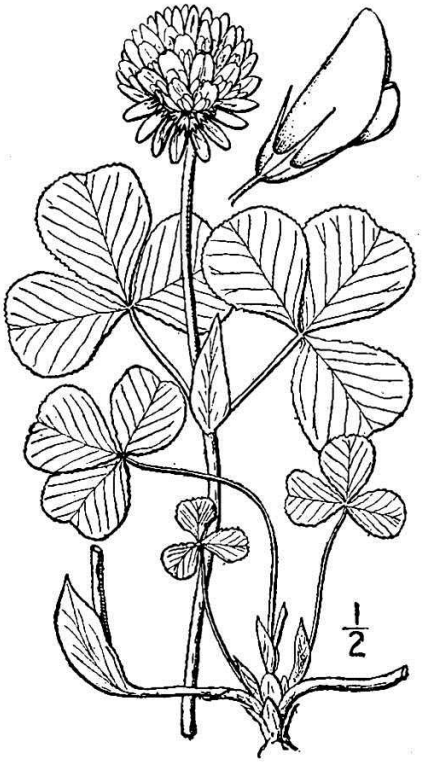
# Running Buffalo Clover (*Trifolium stoloniferum*)

## Species Description

Running buffalo clover (*Trifolium stoloniferum*) was listed as **endangered** on July 6, 1987.

Photo Credit: Third Rock Consultants, Lexington, KY

A member of the Pea family (*Fabaceae*), running buffalo clover is a terrestrial, perennial herb that produces runners (stolons) which extend from the base of erect stems and run along the surface of the ground. These runners are capable of rooting at nodes and expanding the size of small clumps of clover into larger ones. The leaves are divided into three leaflets.




1Britton, N.L., and A. Brown. 1913. *An illustrated flora of the northern United States, Canada and the British Possessions. 3 vols.* Charles Scribner's Sons, New York. Vol. 2: 357. Courtesy of Kentucky Native Plant Society. Scanned by Omnitek Inc.

Running buffalo clover is a dicot with small (1-inch wide), white flowers that grow on stems that are 2 to 8 inches long. Each flower has two large opposite leaves (with 3 leaflets) below it on the flowering stem. It is recognizable in the field from mid-April to late summer but is most easily recognized when blooming, usually from mid-May to mid-June. Pedestrian surveys should be conducted during this time in areas of favorable habitat.

## Habitat Description

Running buffalo clover was historically associated with buffalo, buffalo traces and relatively open savannah woodlands. With only one known exception, it is associated with limestone-based soils. The exception is a small West Virginia population on a sand-gravel bar of unknown origin (Harmon 2006). It is dependent on partial shade (often described as filtered sunlight) and moderate, periodic disturbance for its continued survival. Disturbance can be soil scouring from run-off or flooding, hoof disturbance by grazing livestock, mowing and foot, vehicle, or logging trails.

In Kentucky, running buffalo clover has been found in both wooded uplands and on floodplains, the latter predominating. Almost one-fourth of the Kentucky sites are located within lawns or cemeteries that have a history of long occupation, some going back to early settlement time. All existing populations are associated with some form of local disturbance in a wooded, or partially wooded setting: cattle or deer trails, foot or vehicle trails, dirt roads, logging roads, periodic mowing, grazing, moderate overland flow erosion, or flood scour.

Wooded upland - open savanna-like habitat that is grazed and is partially shaded

Floodplain habitat – partial shade and an open understory in the foreground; a dense, heavily shaded understory in the background

Open, grazed woods on small ravine showing soil disturbance by cattle and filtered sunlight; this photo is a good example of a completely open understory

Photo Credits: Third Rock Consultants, Lexington, KY

Running buffalo clover has also been found on the partially shaded, higher portions of gravel bars in small streams where the area is periodically scoured but stable enough to support herbaceous vegetation and on bars in upland ephemeral streams in woods.

Forests that support running buffalo clover may be young or old, but they do not have a dense canopy or dense understory that creates heavy shade in the local areas where the clover exists. Soils that support running buffalo clover are limestone based, basic or only slightly acidic, relatively deep, moderately moist, but well-drained. Running buffalo clover is not associated with wetlands, poorly drained or somewhat poorly drained soils or excessively well-drained, dry, thin, rocky soils.

Common woody and herbaceous species found associated with running buffalo clover include: box elder (*Acer negundo*), sugar maple (*Acer saccharum*), black walnut (*Juglans nigra*), clearweed or richweed (*Pilea pumila*), and all too frequently, white clover (*Trifolium repens*), a direct competitor.

Yard of older home that could support patches of running buffalo clover along the edges of trees and shrubs

A partially shaded ephemeral stream showing disturbance by both scour and cattle

Riparian areas and upper portions of gravel bars that could support running buffalo clover; flood scour and grazing provide the necessary disturbance.

Photo Credits: Third Rock Consultants, Lexington, KY

The decline of this once fairly abundant species has been attributed to land clearing, the reduction of periodic fire resulting in a closed forest canopy, excessive grazing, and the introduction of non-native species. Exotic species, including introduced clovers, can out-compete running buffalo clover on less than optimum sites. Removal of partial shade will lead to its rapid decline and disappearance, often within a single growing season. Alternatively, it does not exist under a dense canopy or a dense understory that creates heavy shade.

The most likely impacts associated with transportation projects are land clearing and subsequent habitat destruction; or selected tree removal, resulting in loss of partial shade conditions. New corridor construction, widening that requires clearing, bridge replacements that require clearing or tree removal, and borrow or fill areas that are located in wooded or partially wooded areas prior to use, are all activities that could impact running buffalo clover.

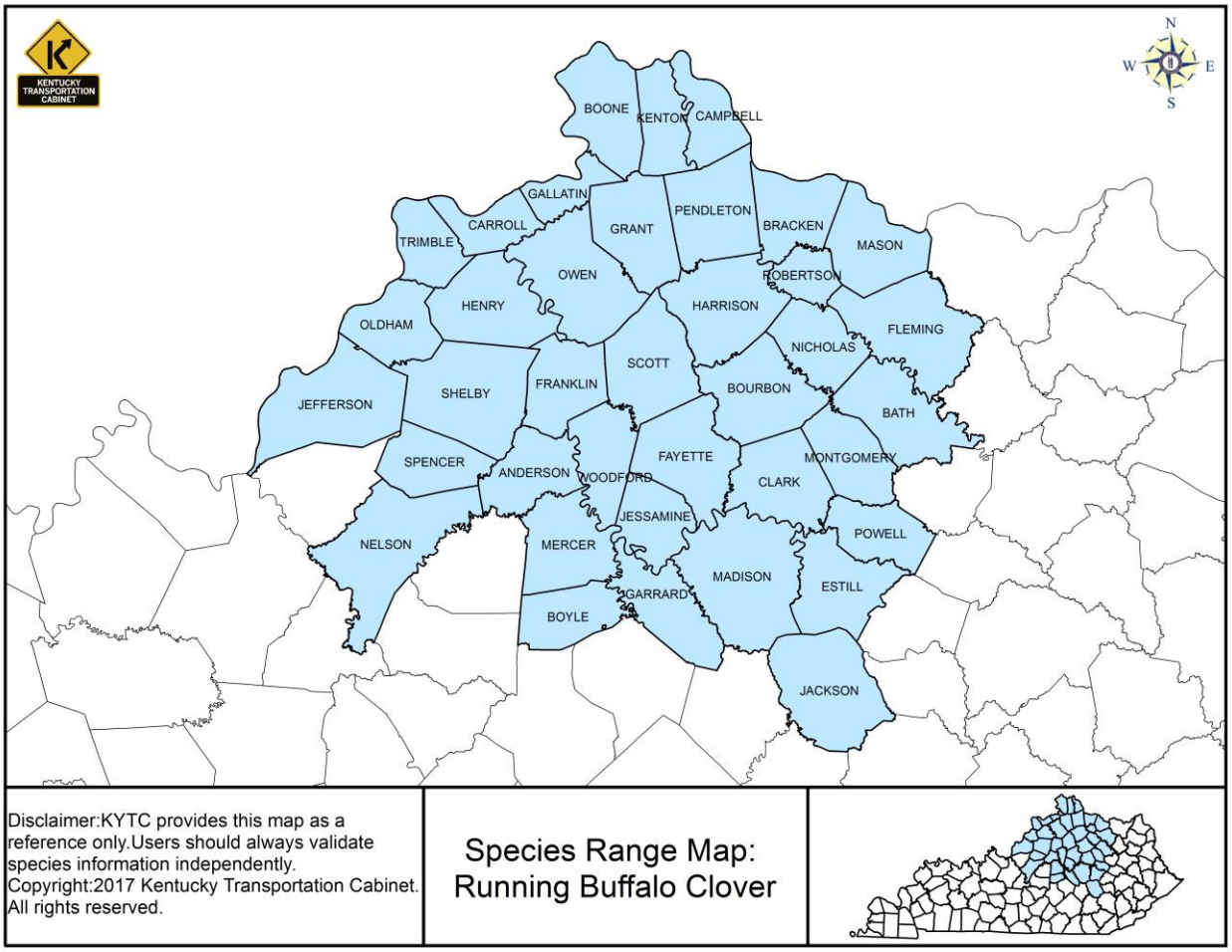
## Critical Habitat

None

## Range

Historically, the species was known from northern Arkansas, southern Missouri, eastern Kansas, southern Illinois, central and southern Indiana, central and southern Ohio, central Kentucky, and central and northern West Virginia.

Kentucky has the largest number of populations (66) of any of the states in which it is still known to exist. Its location is known in 14 counties; however, running buffalo clover is currently listed for 38 counties in northern and central Kentucky. It has been closely identified with both the inner and outer Bluegrass regions, with one known exception: a recent record from the western edge of Jackson County. The Jackson County site is on the extreme eastern edge of the Pennyroyal physiographic province and is located on a limestone based soil.



## Decision Key

*Office Assessment:*

1) Does the project area occur on well-drained, limestone-based soils?
    a. Yes: Continue to Step 2
    b. No: Prepare NE finding

*Field Assessment:*

2) Are there old homesteads or cemeteries (100 years old or more) containing trees?
    a. Yes: Contact SME
    b. No: Continue to Step 3

3) Does the project area contained wooded areas with partial shade and show signs of periodic disturbance (e.g. mowing, flooding, grazing, foot/vehicle/logging trails, etc.)
    a. Yes: Contact SME
    b. No: Prepare NE finding

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# Short's Bladderpod (*Physaria globosa*)

AKA: *Lesquerella globosa*, Lesquereux's bladderpod, Globe's bladderpod

## Species Description

Short's bladderpod (*Physaria globosa*) was listed as **endangered** species on August 1, 2014.

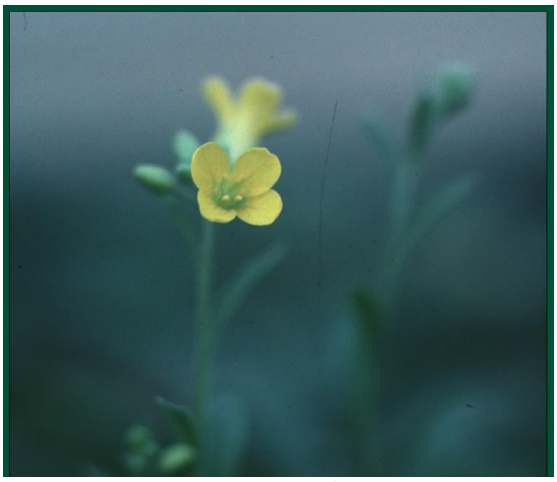


Photo by: Lucille McCook, Center for Plant Conservation

A member of the Mustard family (*Brassicaceae*), Short's bladderpod is a short-lived, perennial herb with slender, leafy stems that spread from the base and are 30-50 cm tall. This form can occasionally give vigorous plants a bushy appearance. The leaves are densely hairy which results in a grayish-green color. The leaves are simple, oblong-shaped and alternate on the stem.


Photo Credit: USDA-NRCS PLANTS Database: Britton, N.L. and A. Brown. 1913. An illustrated flora of the northern United States, Canada, and the British Possessions. 3 vols. Charles Scribner's Sons, New York. Vol. 2: 155.

Short's bladderpod is a dicot with small flowers bright yellow to yellow-orange in color. The flowers are cross-shaped with each having 4 spoon/spatula-shaped petals about 5mm long. Flowers typically bloom from approximately March to May. Pedestrian surveys should be conducted during this time in areas of favorable habitat. Fruit produced is a nearly globe-shaped capsule, about 3 mm in diameter, with 1 or 2 seeds in each cell.

Little is known about the ecological life cycle of the species. Populations may vary greatly from year to year, and flowering events may or may not occur every year.

## Habitat Description

Short's bladderpod is a native species that is distributed throughout Indiana, Kentucky, and Tennessee. Short's bladderpod inhabits steep, rocky, wooded slopes and talus areas (rocky debris at the base of a slope) at the base of cliffs, and often occurs in areas on or along major waterways (e.g. Cumberland River). It prefers dry limestone rocks and open rock ledges, or calcareous soils in cedar glades. Short's bladderpod can also be found in shale at the base of cliffs, and on artificial surfaces (e.g. roadcuts).

Common woody species associated with Short's bladderpod habitat include boxelder (*Acer negundo*), red maple (*Acer rubrum*), Ohio buckeye (*Aesculus glabra*), sugarberry (*Celtis occidentalis*), redbud (*Cercis canadensis*), white ash (*Fraxinus americana*), eastern red cedar (*Juniperus virginiana*), Japanese honeysuckle (*Lonicera japonica*), Virginia creeper (*Parthenocissus quinquefolia*), coralberry (*Symphoricarpos orbiculatus*), and American elm (*Ulmus americana*). Common herbaceous associates include garlic mustard (*Alliaria petiolata*), wild hyacinth (*Camassia scilloides*), spreading chervil (*Chaerophyllum procumbens*), dwarf larkspur (*Delphinium tricorne*), cleavers (*Galium aparine*), deadnettle (*Lamium* spp.), fernleaf phacelia (*Phacelia bipinnatifida*), Solomon's seal (*Polygonatum biflorum*), widowscross (*Sedum pulchellum*), firepink (*Silene virginica*), and common mullein (*Verbascum thapsus*).

Threats to Short's bladderpod habitat may include activities such as road construction, roadside mowing and maintenance, trash dumping, grazing, competition with invasive species, and possible excessive shade.

## Critical Habitat

Yes (See more detailed information after the decision key)

**See primary constituent elements list after the decision key.

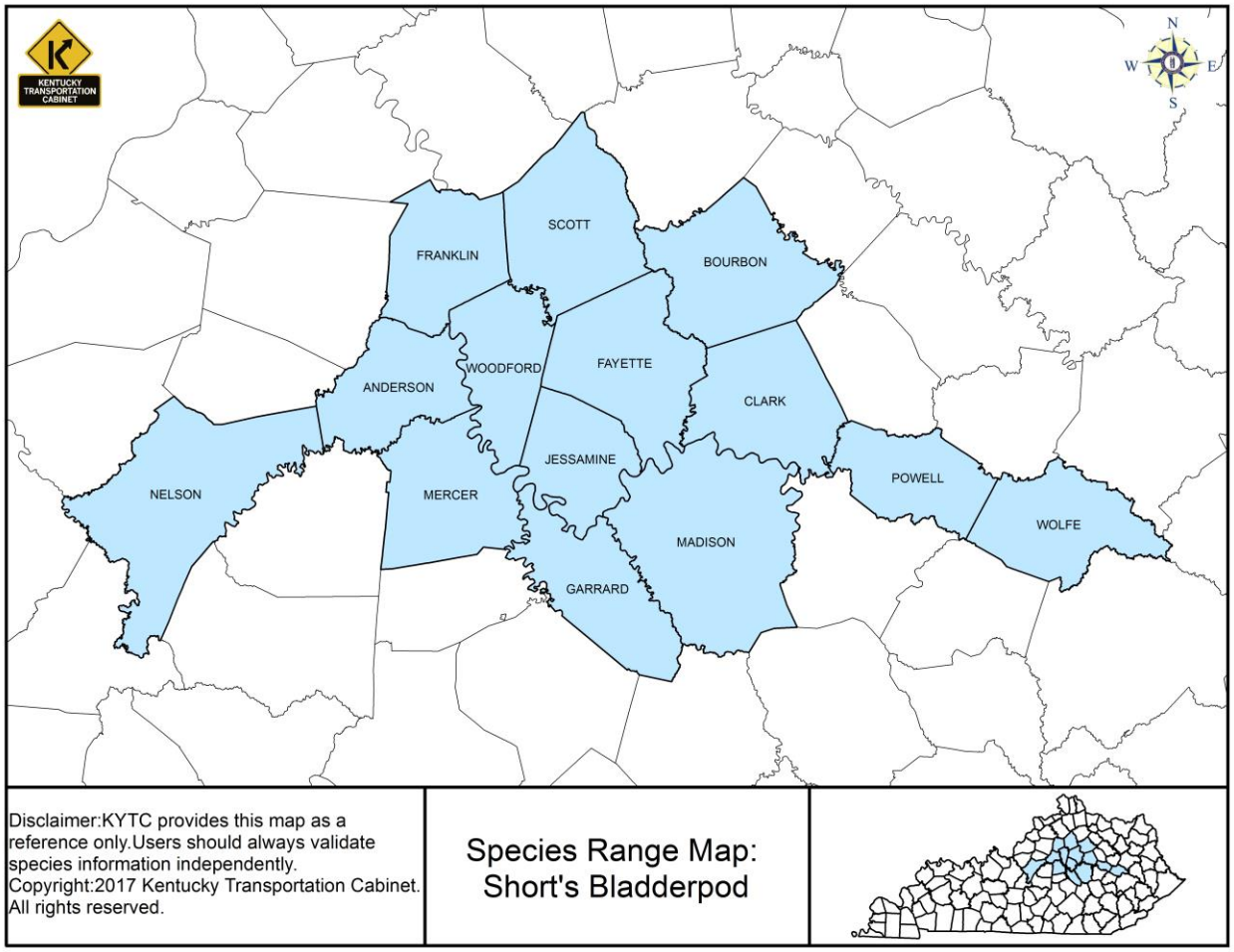
In 2014, the USFWS designated 20 units as critical habitat for this species. Only six of these units occur within Kentucky (units #14 – 19).

| Critical habitat unit | Private ha (ac) | State/local ha (ac) | Federal ha (ac) | Size of unit ha (ac) |
|---|---|---|---|---|
| 1. Kings and Queens Bluff (TN) | 7.6 (18.9) | -------- | *3.0(7.3) | 7.6 (18.9) |
| 2. Lock B Road (TN) | 10.1 (25.0) | -------- | *0.3 (0.8) | 10.1 (25.0) |
| 3. Jarrel Ridge Road (TN) | 5.2 (12.8) | -------- | *0.4 (1.1) | 5.2 (12.8) |
| 4. Cheatham Lake (TN) | 19.1 (47.2) | 3.4 (8.3) | 4.9 (12.0) | 27.3 (67.5) |
| 5. Harpeth River (TN) | 8.2 (20.3) | -------- | 17.3 (42.8) | 25.5 (63.1) |
| 6. Montgomery Bell Bridge (TN) | 2.1 (5.3) | -------- | 9.0 (22.3) | 11.2 (27.7) |
| 7. Nashville & Western R.R. (TN) | 20.8 (51.4) | 8.1 (20.0) | 1.5 (3.8) | 30.5 (75.3) |
| 8. River Trace (TN) | 42.8 (105.7) | -------- | *5.6 (13.8) | 42.8 (105.7) |
| 9. Old Hickory Lake (TN) | 1.9 (4.8) | -------- | 2.9 (7.1) | 4.8 (11.9) |
| 10. Coleman-Winston Bridge (TN) | 4.1 (10.1) | -------- | 3.3 (8.1) | 7.4 (18.2) |
| 11. Cordell Hull Reservoir (TN) | -------- | -------- | 12.3 (34.2) | 12.3 (34.2) |
| 12. Funns Branch (TN) | -------- | -------- | 20.8 (51.3) | 20.8 (51.3) |
| 13. Wartrace Creek (TN) | -------- | -------- | 37.5 (92.6) | 37.5 (92.6) |
| 14. Camp Pleasant Branch (KY) | 17.4 (42.9) | -------- | -------- | 17.4 (42.9) |
| 15. Kentucky River (KY) | 83.7 (206.7) | 9.4 (23.3) | -------- | 93.1 (230.0) |
| 16. Owenton Road (KY) | 1.3 (3.3) | 1.5 (3.7) | -------- | 2.8 (7.0) |
| 17. Little Benson Creek (KY) | 9.4 (23.3) | -------- | -------- | 9.4 (23.3) |
| 18. Boone Creek (KY) | 5.0 (12.4) | -------- | -------- | 5.0 (12.4) |
| 19. Delaney Ferry Road (KY) | 0.6 (1.4) | -------- | -------- | 0.6 (1.4) |
| 20. Bonebank Road (IN) | -------- | 1.7 (4.3) | -------- | 1.7 (4.3) |
| **Total** | 239.3 (591.5) | 24.1 (59.6) | 118.8 (297.2) | 373.0 (925.5) |

*Indicates U.S. Army Corps of Engineers easements, which are not added to Size of Unit because these lands are included in ha (ac) figure given for the private lands on which easements are held.

## Range

Short's bladderpod is a native species that is distributed throughout Indiana, Kentucky, and Tennessee. Currently, this species is listed for 14 counties in northeastern Kentucky. Shea (1993) and Cranfill et al. (1985) list populations of an uncertain status, historic populations, or incomplete listings in Jessamine, Fayette, Madison, Mercer, and Powell Counties within Kentucky. As of 2011, only 8 populations were extant in Kentucky.



## Decision Key

1) Does the project area contain calcareous limestone bedrock or outcrops, (sometimes with interbedded shale or siltstone) near the Kentucky River or its tributaries?

    a. Yes: Continue to Step 2
    b. No: Prepare NE finding

2) Does the project area contain shallow or rocky, well-drained soils? These soils should be undisturbed or subjected to minimal disturbances.

    a. Yes: Continue to Step 3
    b. No: Prepare NE finding

3) Does the project area contain open areas with limited shade??

    a. Yes: Contact SME
    b. No: Prepare NE finding

## Short's Bladderpod Critical Habitat Areas

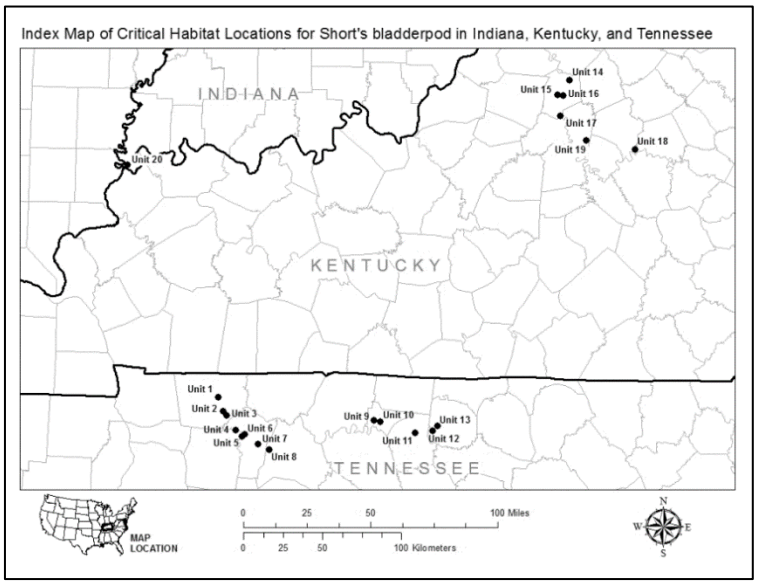
Primary constituent elements of critical habitat for this species include:

(1) Bedrock formations and outcrops of calcareous limestone, sometimes with interbedded shale or siltstone, in close proximity to the main stem or tributaries of the Kentucky and Cumberland rivers. These outcrop sites or areas of suitable bedrock geology should be located on steeply sloped hillsides or bluffs, typically on south- to west-facing aspects.

(2) Shallow or rocky, well-drained soils formed from the weathering of underlying calcareous bedrock formations, which are undisturbed or subjected to minimal disturbance, so as to retain habitat for ground-nesting pollinators and potential for maintenance of a soil seed bank.

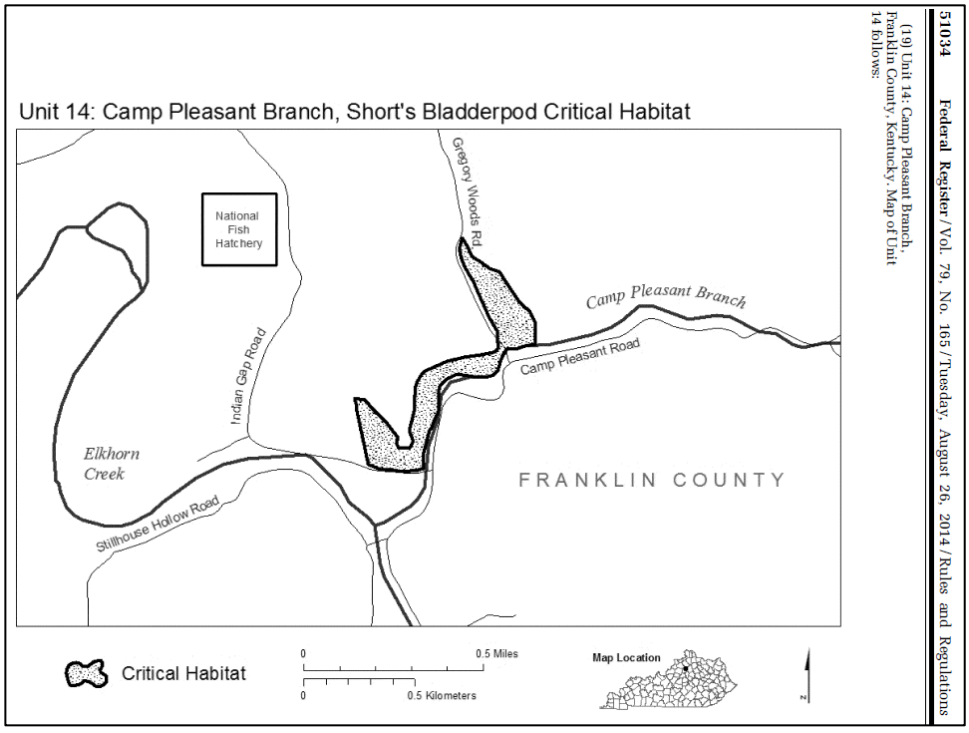
(3) Forest communities with low levels of canopy closure or openings in the canopy to provide adequate sunlight for individual and population growth. Invasive, nonnative plants must be absent or present in sufficiently low numbers to not inhibit growth or reproduction of Globe's bladderpod.

*** The features essential to the conservation of the species in these proposed critical habitat units may require special management considerations or protection to address threats related to changes in land use, including residential or commercial construction, which could cause removal of forest vegetation or soils or soil loss due to erosion; potential right-of-way construction or maintenance using herbicides or mechanized equipment along roads which are adjacent to the unit; and shading or competition due to encroachment of native and invasive, nonnative plants.




***Unit 14. Camp Pleasant Branch, Franklin County, Kentucky.***

Unit 14 consists of 17.4 ha (42.9 ac) of privately owned lands in Franklin County, Kentucky. This unit is located approximately 8.3 km (5.8 mi) north of the city limits of Frankfort, on the hillsides near Camp Pleasant Branch, a tributary to Elkhorn Creek. Beginning approximately 0.29 km (0.81 mi) west of the intersection of Indian Gap Road and Camp Pleasant Road, the unit begins in a hollow north of Indian Gap Road and extends to the east and north along hillsides above the right descending bank of Camp Pleasant Branch for approximately 0.75 km (0.5 mi) to the intersection of Camp Pleasant Road and Gregory Woods Road. Here the unit crosses Gregory Woods Road and extends north for a distance of approximately 0.58 km (0.36 mi), encompassing the hillside to the east of the road.

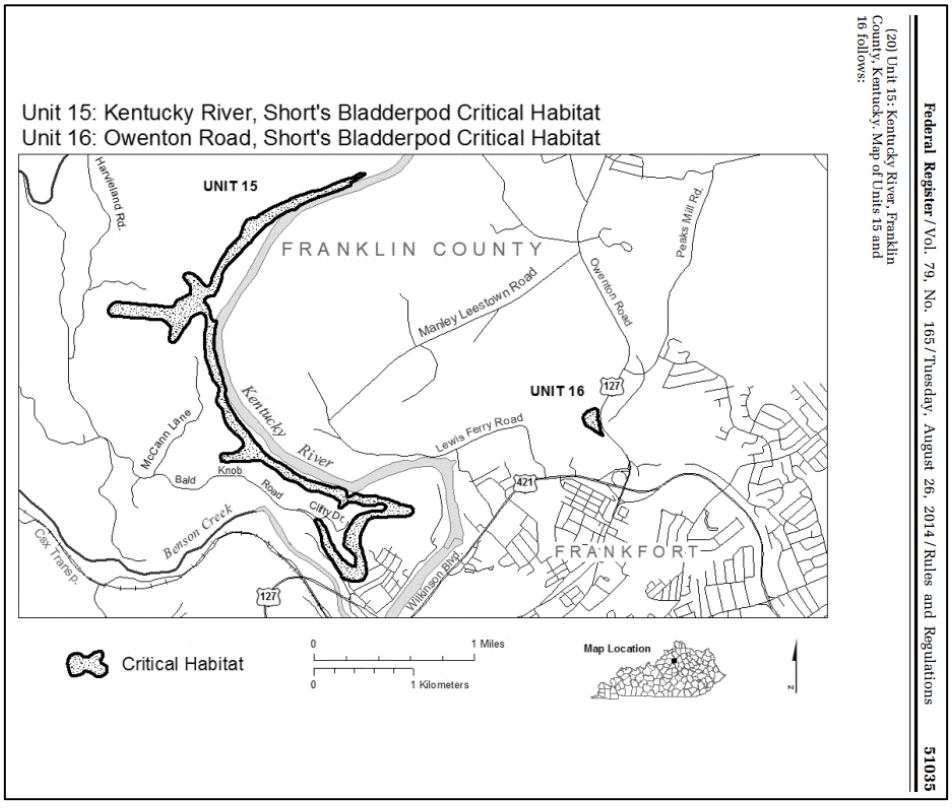


***Unit 15. Kentucky River, Franklin County, Kentucky.***

This unit consists of 93.1 ha (230.0 ac) of privately owned and State land in Franklin County, Kentucky. This unit begins within the northwestern city limit of Frankfort, on a hillside that parallels US-421 on its east side from approximately 0.21 km (0.13 mi) southeast if its junction with Clifty Drive to approximately 0.23 km (0.15 mi) northwest with its junction with US-127. Here the unit follows the topography of the hillside as it turns away from the road to the east, leaving the city limits, and then arcs to the northeast, before abruptly turning back in a westerly direction. From this point, the hillside and this unit extend in a westerly direction for approximately 0.7 km (0.4 mi) and then parallel the Kentucky River in a downstream direction in an arc approximately 5.3 km (3.3 mi) in length on its left descending bank, encompassing hillsides in two hollows that extend from the river to the west. Approximately 90 percent of the land in this unit is privately owned, and the Commonwealth of Kentucky owns approximately 10 percent, which is part of a State nature preserve.

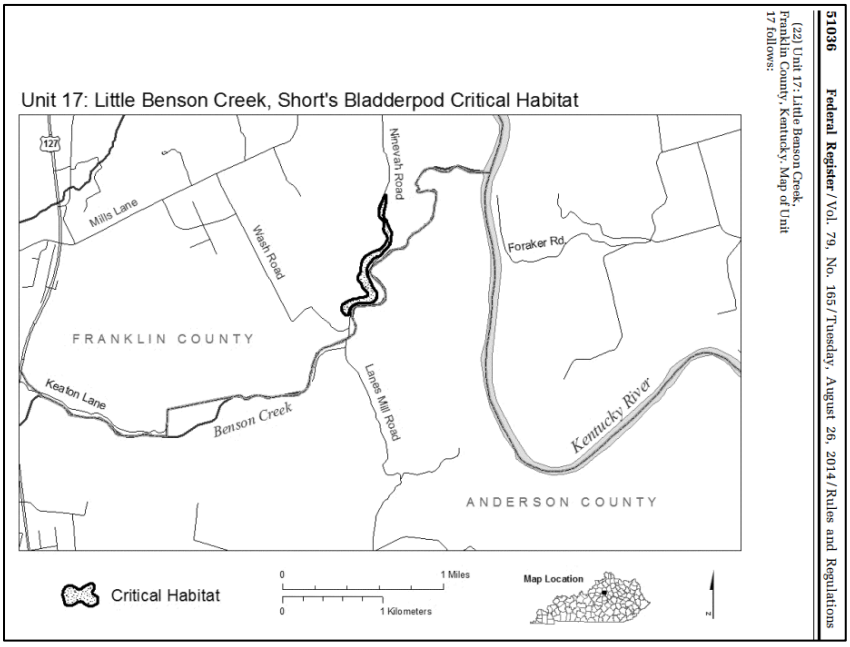
***Unit 16. Owenton Road, Franklin County, Kentucky.***

Unit 16 consists of 2.8 ha (7.0 acres) of privately owned and City of Frankfort municipal park lands in Franklin County, Kentucky. The unit is located approximately 0.1 km (0.08 mi) north of the city limits of Frankfort on a hill that is adjacent to and west of US-127 (Owenton Road), approximately 0.6 km (0.4 mi) north of the intersection of US-127 and US-421. The land within this unit is approximately 46 percent privately owned, and 54 percent is owned by the city of Frankfort.



***Unit 17. Little Benson Creek, Franklin County, Kentucky.***

Unit 17 consists of 9.4 ha (23.3 ac) of privately owned lands in Franklin County, Kentucky, located within the city limits of Frankfort. Beginning approximately 1.1 km (0.7 mi) south of the intersection of Mills Lane and Ninevah Road, the unit lies on a hillside on the east side of Ninevah Road and extends to the south for approximately 0.5 km (0.3 mi), where it crosses Ninevah Road and follows a hillside that parallels Ninevah Road for approximately 1.0 km (0.65 mi) on its west side.

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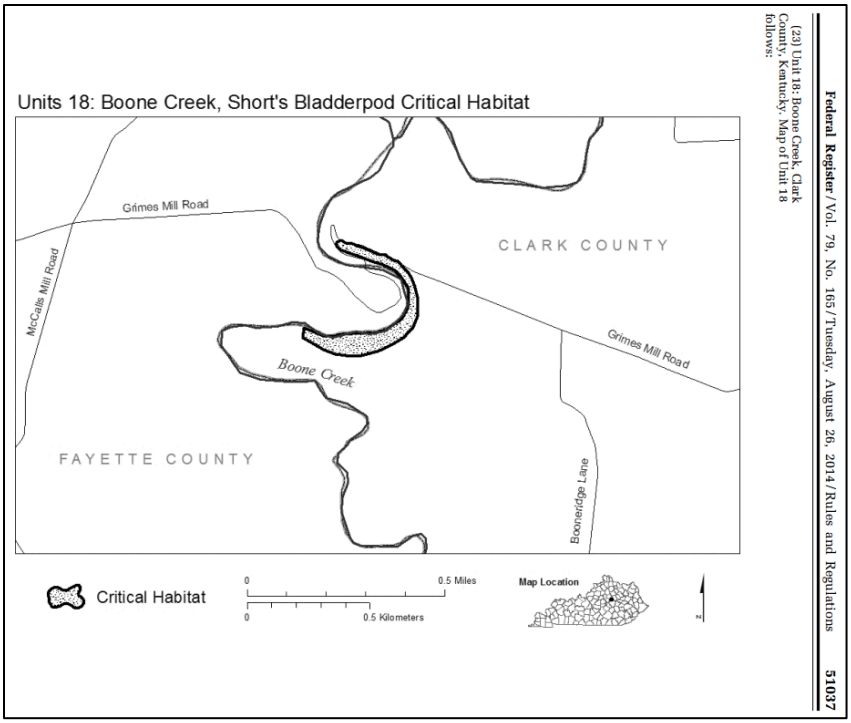
(22) Unit 17: Little Benson Creek, Franklin County, Kentucky: Map of Unit 17 follows:

***Unit 18. Boone Creek, Clark County, Kentucky.***

Unit 18 consists of 5.0 ha (12.4 ac) of privately owned lands in Clark County, Kentucky. This unit is located approximately 13.2 km (8.2 mi) southwest of the city limits of Winchester, and begins adjacent to Grimes Mill Road approximately 0.17 km north of the Fayette and Clark County line. From here, the unit extends on a hillside to the east for a distance of approximately 0.21 km (0.13 mi), where the unit and hillside then parallel a bend in Boone Creek on its left descending bank for a distance of approximately 0.68 km (0.42 mi).

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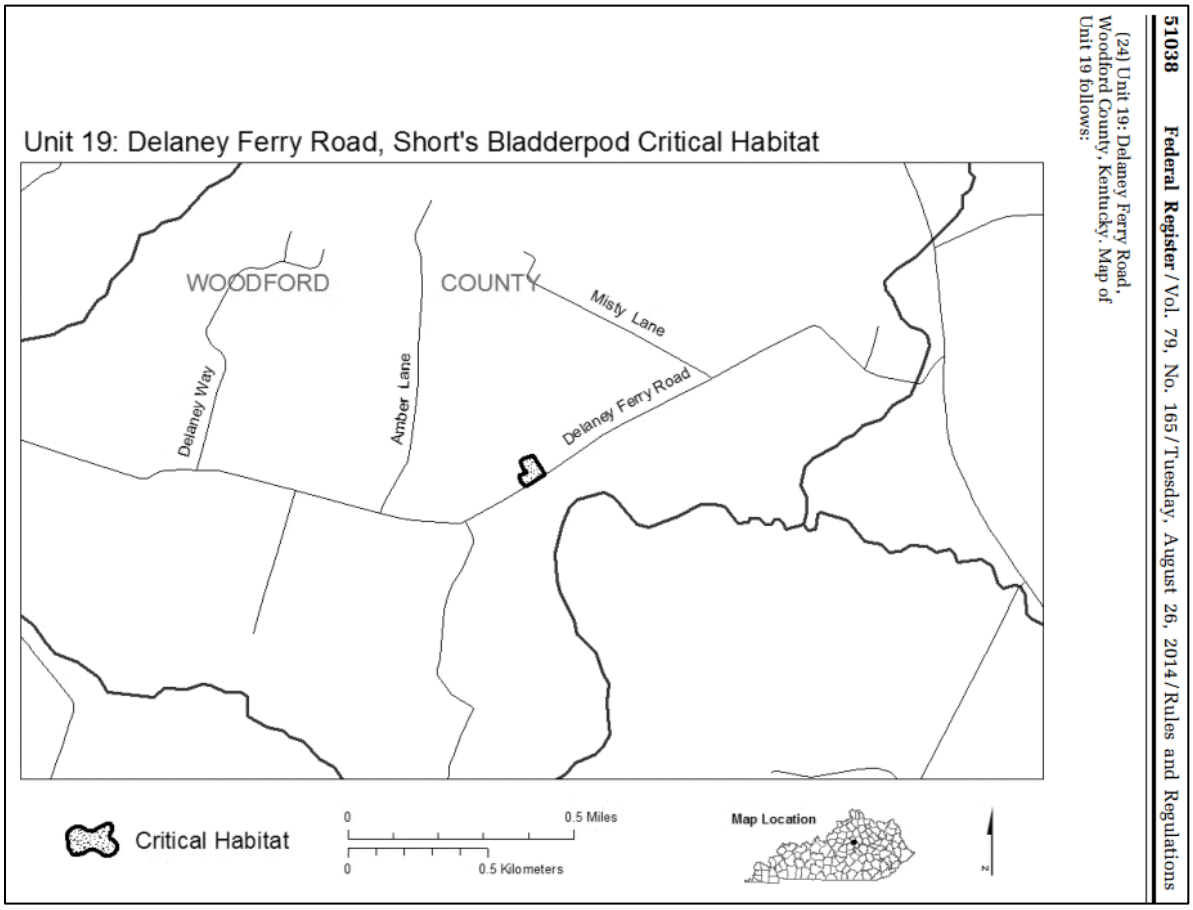
(23) Unit 18: Boone Creek, Clark County, Kentucky: Map of Unit 18 follows:

***Unit 19. Delaney Ferry Road, Woodford County, Kentucky.***

Unit 19 consists of 0.6 ha (1.4 ac) of privately owned lands in Woodford County, Kentucky. This unit is located approximately 7.8 km (4.8 mi) south of the city of Versailles. Beginning approximately 2.1 km (1.3 mi) east of the intersection of Troy Pike and Delaney Ferry Road, this unit extends approximately 0.08 km (0.05 mi) northeast along Delaney Ferry Road, where the unit boundary turns to the northwest for approximately 0.8 km (0.05 mi). From this northeast corner of the unit, the boundary extends to the southwest approximately 0.05 km (0.03 mi), where it turns to the southeast, paralleling a driveway for 0.05 km (0.03 mi) before turning to the southwest for approximately 0.03 km (0.02 mi). From this point the unit boundary turns to the southeast for approximately 0.05 km (0.03 mi), returning to the starting point.
The features essential to the conservation of the species in this unit may require special management considerations or protection to address threats of shading or competition due to encroachment of native and invasive, nonnative plants. The current landowner manages encroaching vegetation to prevent shading and competition where Short's bladderpod occurs within the unit.

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(24) Unit 19: Delaney Ferry Road, Woodford County, Kentucky. Map of Unit 19 follows:

## Literature Cited

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Shea, M.M. 1993. Status survey report on Lesquerella globosa (Desv.) Wats. Frankfort, Kentucky: Prepared under cooperative agreement 14-16-0004-89-956 for the Kentucky Endangered Plant Species Program. p.122.

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U.S. Fish and Wildlife Service. 2014. Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for Physaria globosa (Short's bladderpod), Helianthus verticillatus (whorled sunflower), and Leavenworthia crassa (fleshy-fruit gladecress); Final Rule. 79(165): 50990-51039.

# Short's Goldenrod (*Solidago shortii*)

## Species Description

Short's goldenrod (*Solidago shortii*) was listed as **endangered** on September 5, 1985.

Photo Credit: Third Rock Consultants, Lexington, KY

A member of the Aster family (*Asteraceae*), Short's goldenrod is a terrestrial herb less than 1 meter (39 inches) tall. The leaves are alternate, narrow, 50-10 cm (2-4 inches) long, and 0.6-1.5 cm (0.24-0.60 inches) wide.

Short's goldenrod has small, yellow flowers. Flowers typically bloom from approximately mid-August to early November. Pedestrian surveys should be conducted during this time in areas of favorable habitat. Its fruit is light brown and matures several weeks after the flowers wither.

Several studies on this species ability to compete with other plants indicate that its major competitive advantage is its root structure that allows it to survive in very dry, thin soils, the roots actually penetrate cracks in the underlying limestone

## Habitat Description

Short's goldenrod has historically been associated with buffalo and buffalo traces. It was suggested by Lucy Braun (1941) that bison could have been its primary dispersal vector. The Blue River, Falls of the Ohio, and Blue Licks populations all occur along or near the same historic east-west buffalo trace. Major buffalo traces ran from Blue Licks to the Falls of the Ohio and another, north to the Ohio River where Maysville, Kentucky is now located (Sames 1985). It is plausible that Short's goldenrod could occur anywhere along these routes.

All occurrences of this species are located on small remnant patches of glade/forest complex and none cover more than an acre. These small and highly localized populations are vulnerable to catastrophic impacts such as fire or disease. Buchele *et al*. (1989) counted over 73,000 stems in the Blue Licks area but noted that since the species reproduces vegetatively, this large number of stems may represent relatively few individual genotypes.

The most likely impacts associated with transportation projects are land clearing and subsequent habitat destruction resulting in loss of cedar-glade habitats (grassy openings where the bedrock, most often limestone, is exposed or covered in patches by only a thin layer of soil). New corridor construction, widening that requires clearing, bridge replacements that require clearing or tree removal, and borrow or fill areas that are located in forest openings, open glades, or pastures prior to use, are all activities that could impact Short's goldenrod. Threats to Short's goldenrod may also include exotic plants, trampling and fire.

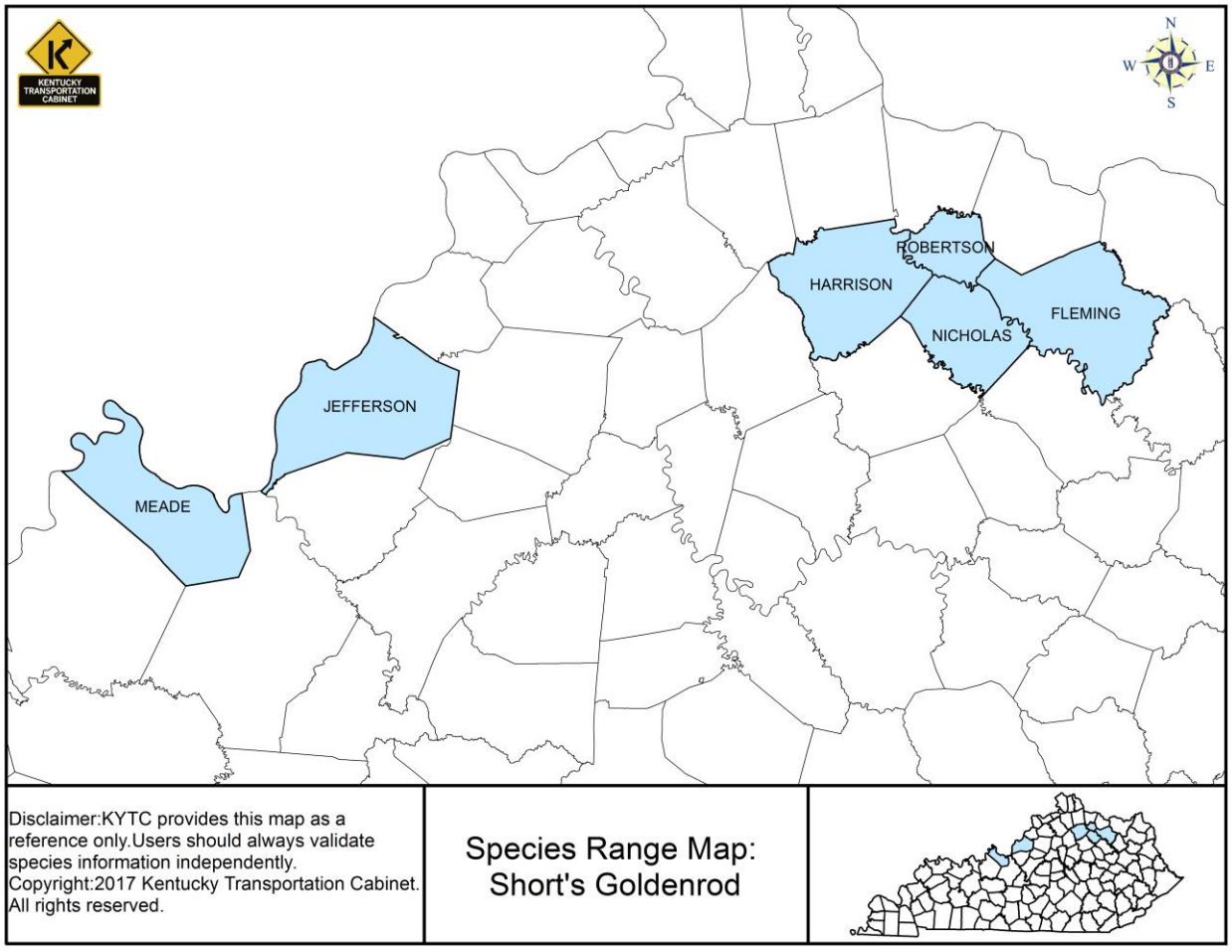

Cedar glade habitat. Notice thin soils with exposed rock, lack of overstory trees.

## Critical Habitat

None

## Range

Short's goldenrod is currently known only from north-central Kentucky and the lower Blue River in southern Indiana. The Kentucky occurrences are all clustered in a small area near the juncture of Fleming, Nicholas, and Robertson counties, centered around Blue Licks Battlefield State Park. A historical record for Short's goldenrod exists from Rock Island adjacent to the Falls of the Ohio in Jefferson County. Two occurrences are associated with the right-of-way fencelines of US 68 and KY 165. This site was later inundated in the early 1900s by dam construction. Currently, this species is listed for six counties in Kentucky.



## Decision Key

*Office Assessment*:

1) Is the project area located on Grier, Tanglewood, Kope, or Clays Ferry members of the Lexington Limestone Formation?

    a. Yes: Continue to Step 2
    b. No: Prepare NE finding

2) Does the project involve right-of-way near US 68 or KY 165?

    a. Yes: Contact SME
    b. No: Continue to Step 3

*Field Assessment*:

3) Will the project impact cedar glades, other glade-like habitat, over-grazed rocky pastures, or existing road-cuts?

    a. Yes: Contact SME
    b. No: Prepare NE finding

## Literature Cited

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Wallace, R. M. 1978. Geologic map of the Piqua Quadrangle, northeastern Kentucky. United States Geological Survey, Reston, Virginia.

# Virginia Spiraea (*Spiraea virginiana*)

## Species Description


Virginia spiraea (*Spiraea virginiana*) was listed as **threatened** on June 15, 1990.

A member of the Rose family (*Rosaceae*), Virginia spiraea is a shrub that reaches 2-8 feet tall. It is clonal and considered to be a prolific sprouter (evident by its dense clumps that spread into rock crevices and around boulders). The leaves are alternate and vary in characteristics of size, shape and degree of serration. The flowers are cream-colored and form in branched, flat-topped inflorescences with a width of 4-8 inches. Virginia spiraea is best recognized in the field in June and July when it flowers, but can be identified by its leaves from May through late summer.

Because there are so few isolated populations, it is thought that it currently only reproduces vegetatively. This vegetative reproduction is by underground stem extension or by portions of the plant breaking off in a flood and being re-deposited and rooting in another location downstream. As a result, the plants of an isolated population are actually clones of a single genotype. Despite profuse flowering, most populations do not produce viable seed (thought to be caused by a lack of cross-pollination). The restriction to a single method of reproduction makes these isolated populations much more vulnerable to extirpation.

Competition appears to be the most important variable related to the survival of this species. Shading by trees, vines, or fast-growing herbaceous vegetation is tolerated for a time, but will eventually eliminate Virginia spiraea. Flood scour is necessary to topple the larger, heavier trees

and wash out many herbs and vines, without being so extreme to wash out the spiraea's fine fibrous root mass or heavy lateral rhizomes. Even though a great deal of aboveground plant material may be lost during scour episodes, the below-ground portions of Virginia spiraea are usually capable of regenerating the clone (Harper 1977). Senescence, observed in some older clones, may decrease the risk of a plant being washed out during flood events by decreasing the above-ground vegetative mass.

## Habitat Description

Virginia spiraea is found along the banks of fourth order or larger streams, on point bars, natural levees, braided features of lower stream reaches, and along rocky, flood-scoured banks. The banks, terraces, and gravel bars where the majority of the populations are found, are associated with the mouths of tributaries or on the outside of bends. The bedrock surrounding Virginia spiraea can be either sandstone or limestone and soils are acidic and moist. This species is associated with sites that are rocky, have thin soils, and are not generally conducive to the growth of other plants.

Nearly all of the Kentucky occurrences are found on high gradient streams with good water quality. Stream gradient is important for the flood regime that establishes and maintains the open habitat that supports this species. The gradient and storm flow, which are conducive to flood scouring, maintain the necessary canopy openings along the shoreline. The floods must have enough volume and enough turbulence to remove tree species that would eventually shade this shrub species. It grows best in full sun, but can tolerate partial shade. Streams with a mature, stable closed canopy over the watercourse would not have sufficient light to support this species.

The most likely impacts associated with transportation projects are loss of habitat due to the placement of bridge piers along stream banks and on islands. New bridge piers, in-stream or near the banks, can also alter the normal flow pattern and current velocity, causing increased erosion or deposition on existing downstream bar habitat. The removal or placement of boulders either in stream or on banks could also alter or destroy existing habitat.
(*See Species Description for further information on Competition*)

## Critical Habitat

None

## Range

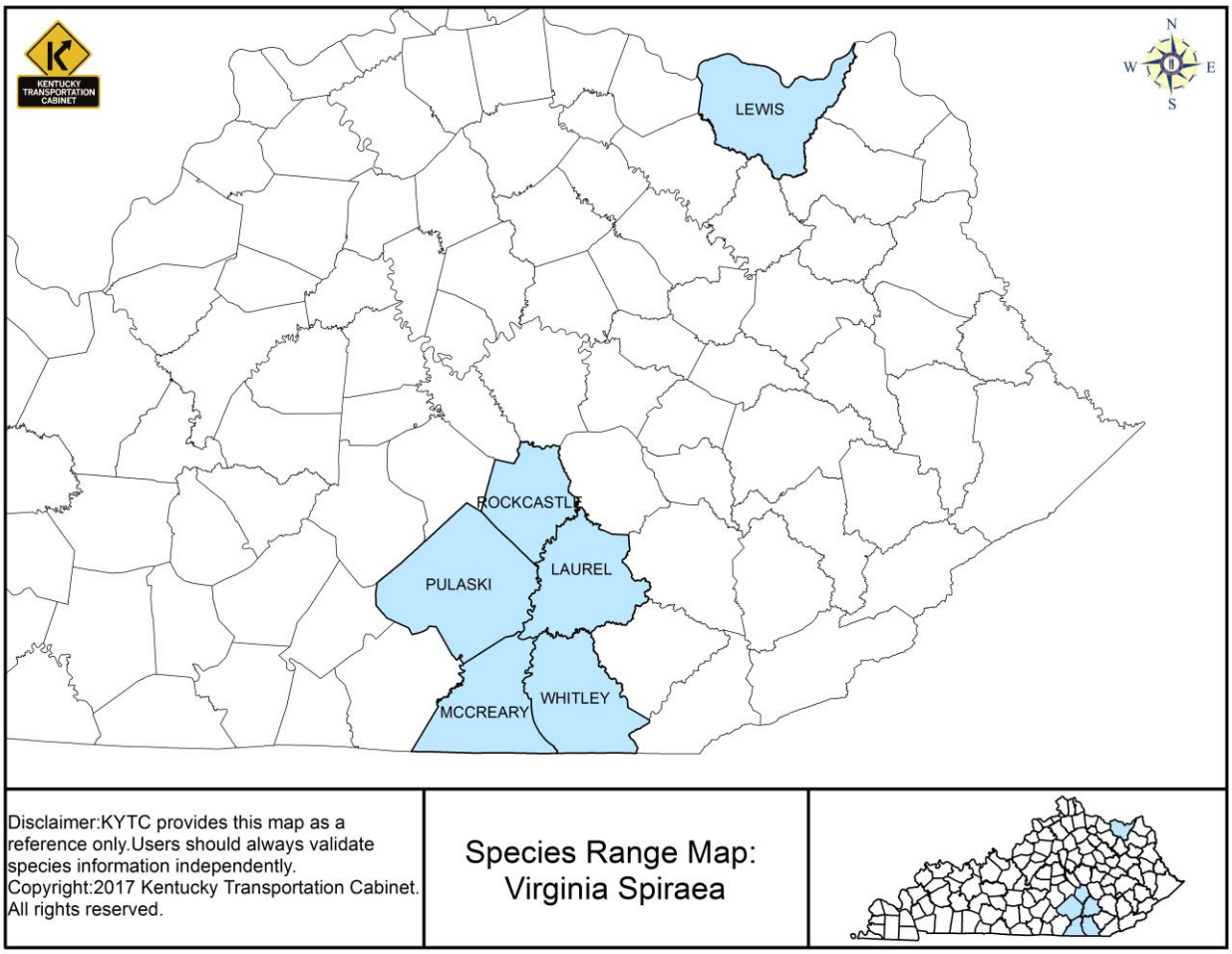
There are 24 known populations in seven states – West Virginia, Virginia, Tennessee, North Carolina, Kentucky, Ohio and Georgia, down from 39 populations in eight states. Thirteen of the 24 populations contain less than 10 plant clumps; eight sites have 10 to 50 clumps, and only three sites have more than 50 clumps (Department of Interior 1990). West Virginia has the largest population with 5,700 plants (Rawinski 1988).

In Kentucky, the range of Virginia spiraea is disjunct since the southern distribution includes drainages in five counties on the Cumberland Plateau while the northern part is exclusively from Kinniconick Creek, a Lewis County stream that drains directly into the Ohio River. There are 20 known occurrences cited in the recovery plan on three Kentucky streams (USFWS 1992). J.N. Campbell, in 1987, located this species on the Rockcastle River in Pulaski County, and additional plants were located along Sinking Creek in Laurel County, a tributary of the Rockcastle River. There are eight sites on Kinniconick Creek in Lewis County that were discovered in 1992. M. Shea located additional populations on both the Rockcastle River and Sinking Creek in 1992. There are now three known sites located on the Rockcastle (Pulaski County) and nine known sites located along Sinking Creek (Laurel County). Additional occurrences of this species, discovered since the recovery plan was written, are from Marsh Creek in McCreary County, the Laurel River in Whitley County, and the Rockcastle River in Rockcastle County.

A population is known from the Russell Fork on the Virginia side of Breaks Interstate Park, but no plants have been found downstream in Pike County, Kentucky to date.

There are two literature citations for occurrences of Virginia spiraea from Edmonson and Barren Counties in 1876. However, these citations are not backed up with voucher specimens and there are no populations currently known in the area.

Currently, this species is listed for six counties in Kentucky.




## Decision Key

*Office Assessment:*

1) Are there blueline streams in the project area?
    a. Yes: Continue to Step 2
    b. No: Prepare NE finding

*Field Assessment:*

2) Are the blueline streams in the project area wide enough so that most of the stream is unshaded and/or have banks or gravel bars that are flood scoured and unshaded?
    a. Yes: Contact SME
    b. No: Prepare NE finding

## Literature Cited

Department of Interior. US Fish and Wildlife Service. June 15, 1990. Endangered and Threatened Wildlife and plants: Threatened Status Determined for *Spiraea virginiana* (*Virginia spiraea*). Federal Register, 55:116:24241-24246.

Harper, J.L. 1977. Population biology of plants. Academic Press, Inc. New York, NY.

Rawinski, Thomas J. 1988. Final Status Survey Report: The Distribution and Abundance of Virginia Spiraea (*Spiraea virginiana*). Report to the US Fish and Wildlife Service, Newton Corner, MA. 5 pp.

U.S. Fish and Wildlife Service. 1990. Endangered and Threatened Wildlife and Plants; Threatened Status Determined for Spiraea Virginiana (Virginia Spiraea). 55 FR 24241 24247.

U.S. Fish and Wildlife Service. 1992. Virginia Spiraea (*Spiraea virginiana*) Recovery Plan and Life History. (http://www.fws.gov/endangered/).

# White Fringeless Orchid (*Platanthera integrilabia*)

AKA: Monkey-face orchid

## Species Description

White fringeless orchid (*Platanthera integrilabia*) was listed as **threatened** on October 13, 2016.

Photo Credit: http:www.fs.fed.us/wildflowers/plant-of-the-week/Platanthera_integrilabia

A member of the Orchid family (*Orchidaceae*), white fringeless orchid is a terrestrial, perennial herb 50-80 cm tall with tuberous roots. The leaves are simple, lanceolate- or elliptical-shaped, alternate, and restricted to the base of the stem.

Photo Credit: Thomas G. Barnes, USDA-NRCS PLANTS Database

Orchids are known for their diversity and specialization. White fringeless orchid is a monocot with showy, white flowers. The flowers have oblong, spoon/spatula-shaped petals. Flowers are nocturnally sweet-scented and typically bloom from approximately late June to early September (Flora of North America Website; Ladybird Johnson Wildflower Center Website; United States Forest Service Website). Pedestrian surveys should be conducted during this time in areas of favorable habitat.

The ovules of orchids do not develop until fertilization. Mature airborne seed are very small and numerous. These seeds lack endosperm and so for germination to occur, the seed requires nutrients which are supplied by a mycorrhizal relationship with a specific fungus. The spongy layer around the roots (velamen) commonly harbors mycorrhizal fungi (e.g. Sphagnum moss).

## Habitat Description

White fringeless orchid is a native species that is distributed throughout Alabama, Georgia, Kentucky, Mississippi, South Carolina, and Tennessee. Currently, there are approximately 60 extant sites supporting this species.

White fringeless orchid habitat occurs in areas of black, mucky, acidic, organic soil that are wet and remain wet most of the year, all years. Several white fringeless orchid populations have been located in or adjacent to powerline right-of- way areas. Most of the known sites for this species occur in or near areas that are managed for timber production, which often provides the partially shaded habitat areas which white fringeless orchid requires. Maintenance of a streamside management zone (SMZ) may be beneficial in attempts to retain white fringeless orchid habitat. One of the largest remaining populations of white fringeless orchid occurs within the wet meadow wetland at the source of the stream at Marsh Branch, Daniel Boone National Forest, Jackson County, Kentucky.

Common species associations include *Sphagnum* species, *Osmunda cinnamonea*, *Woodwardia areolata*, and *Thelyptris novaboracensis* in acidic muck or sand. Species associations also include red maple-gum swamps and peaty seeps and stream banks with *Parnassia asarifolia* and *Oxypolis rigidior*.

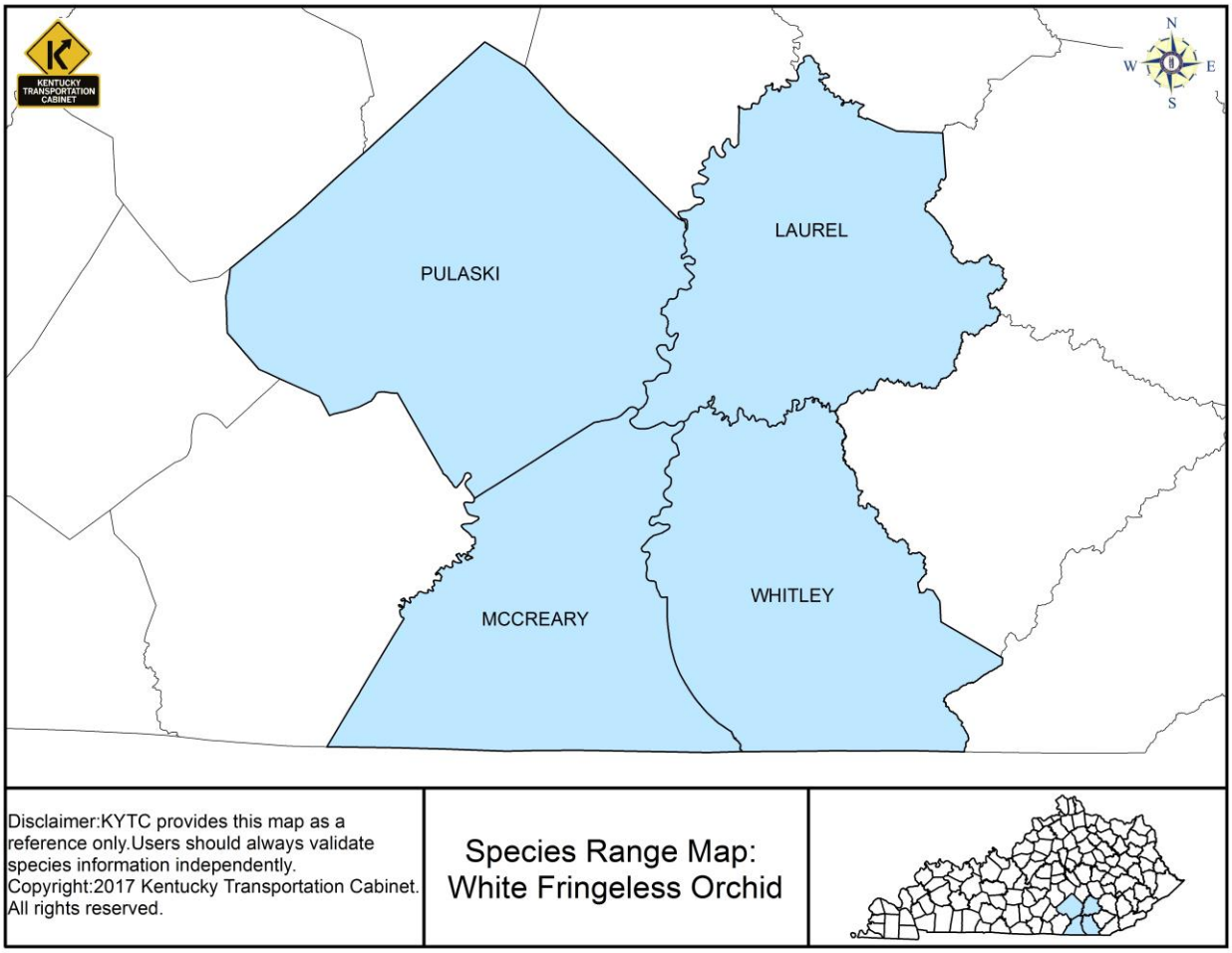
Because of the species' dependence on moderate to high light conditions, active management may be necessary to avoid the development of closed canopy conditions and its associated reduction of available light. Threats to white fringeless orchid habitat may include activities such as road, residential, and commercial construction, herbicide application, commercial collection, herbivory (primarily deer), all-terrain vehicle use, and invasive, nonnative species competition. Additionally, it is important that the soil and site hydrology of the bogs that support this species is not drastically altered, thus preserving necessary habitat conditions.

## Critical Habitat

None

## Range

White fringeless orchid is a native species that is distributed throughout Alabama, Georgia, Kentucky, Louisiana, Mississippi, South Carolina, Tennessee, and Texas. It is presumed extirpated from North Carolina and Virginia. Currently, this species is listed for four counties in southeastern Kentucky.



## Decision Key

1) Does the project area contain wet, boggy areas at the heads of streams or on seepage slopes?

    a. Yes: Continue to Step 2
    b. No: Prepare NE finding

2) Does the area contain partial shade and limited competition by other plant species?

    a. Yes: Continue to Step 3
    b. No: Prepare NE finding

3) Does the project involve alteration of the soil or hydrology of the project area?

    a. Yes: Contact SME
    b. No: Prepare NE finding

## Literature Cited

Biebighauser, T.R. 2007. Wetland Drainage, Restoration, and Repair. University Press of Kentucky. Lexington, K.Y., U.S.A.

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Flora of North America. 2013. *Platanthera integrilabia* (Corell) Luer. FNA 26:552-568. http://www.efloras.org/. Accessed: December 13, 2013.

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Mims, T. 2000. Rare Orchid Finds Safe Haven. Alabama's TREASURED Forests. 29 p. http://www.forestry.state.al.us/Publications/TREASURED_Forest_Magazine/. Accessed: December 13, 2013.

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U.S. Fish and Wildlife Service. 2011. Review of Native Species that are Candidates for Listing as Endangered or Threatened; Annual Notice of Findings on Resubmitted Petitions; Annual Description of Progress on Listing Actions. 76 FR 66370-66439.

Zomlefer, W.B. 1994. Guide to Flowering Plant Families. The University of North Carolina Press. Chapel Hill & London.

# Notable Fish Species

## Cumberland Arrow Darter (*Etheostoma sagitta*)

### Species Description


Photo Credit: http://conservationfisheries.org

The Cumberland arrow darter was formally reviewed, but on October 8, 2015 the USFWS determined that its listing was **not-warranted** due to its frequent occurrences in streams on public lands and in streams with listed species (e.g. blackside dace).

The Cumberland arrow darter is morphology similar to that of the Kentucky arrow darter (*Etheostoma spilotum*); however, the Cumberland arrow darter is found in the 1st-3rd order streams of the upper Cumberland River drainage while the Kentucky arrow darter is found in 1st-3rd order streams of the Kentucky River drainage.

### Literature Cited

U.S. Fish and Wildlife Service. 2015. Endangered and Threatened Wildlife and Plants; 12-Month Findings on Petitions to List 19 Specie as Endangered or Threatened Species. *Federal Registrar* 80(195):60834-60839.

# Notable Insect Species

## Louisville Cave Beetle (*Pseudanophthalmus troglodytes*)

### Species Description


Photo Credit: http://www.insiderlouisville.com

The Louisville cave beetle became a candidate species in 1994(1996); however, on October 6, 2016 the USFWS determined that its listing was **not warranted**. Therefore, no specific action or project review is required in relation to this species.

The Louisville cave beetle is a cave-obligate species known only in five caves in Jefferson County, Kentucky (Eleven Jones Cave, Highbaugh Cave, Sauerkraut Cave, Cave Hill Cave, and Cave Creek Cave). Although this small species is difficult to find and often observed in small numbers, the Service found no concentration of stressors that suggested the species may be in danger of extinction in any portion of its range. Potential threats to this species include: toxic chemical spills, discharges of large amounts of polluted water, closure and alterations of cave entrances, and the disruption of cave energy processes by highway construction and industrial, residential, and commercial development (e.g. reduced energy inputs, sedimentation, pollution, human visitation).

### Literature Cited

U.S. Fish and Wildlife Service. 2016. Endangered and Threatened Wildlife and Plants; 12-Month Findings on Petitions to List 10 Species as Endangered or Threatened Species. Federal Registrar 81(194):69425-69434.

# Notable Plant Species

## Eggert's Sunflower (*Helianthus eggertii*)

### Species Description

Eggert's sunflower was listed as threatened on May 22, 1997, but due to recovery efforts and identified additional populations not previously known this species was **DELISTED** on August 18, 2005.


Accessed via: https://plants.usda.gov

A perennial member of the Aster family (*Asteraceae*), Eggert's sunflower is a tall (~8 feet) plant arising from a short, thick base. Large yellow flowers (3 inches) are borne on the upper third of the stem. Flowering begins in early August and continues through mid-September. Seed germination rates relatively high. Additionally, its extensive rhizome system allows Eggert's sunflower to survive for several years vegetatively, so the plant does not have to produce seeds every year to ensure its survival.

The Eggert's sunflower is known only from Kentucky, Tennessee, and Alabama. It typically occurs on rolling-to-flat uplands and in fill sun or partial shade. It is an early successional species which often found in the barrens, open fields, or in thickets along woodland borders and can persist in roadsides, or power line rights-of-way. At the time of delisting (2005), this species was known to 33 sites in 9 counties in Kentucky.

### Literature Cited

Cruzan, M. 2002. Population and ecological genetics of *Helianthus eggertii*. Final Draft Report. Prepared for Arnold Engineering Development Center at Arnold Air Force Base. 118 pp.

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U.S. Fish and Wildlife Service. 2005. Removal of *Helianthus eggertii* (Eggert's sunflower) from the federal list of endangered and threatened plants. 70 FR 48482-48490.

# White-haired Goldenrod (*Solidago albopilosa*)

## Species Description

Photo Credit: Third Rock Consultants, Lexington, KY

White-haired goldenrod was listed as threatened on April 7, 1988, but due to recovery efforts and protection provided to rock shelter habitats in the Daniel Boone National Forest this species was **DELISTED** on October 11, 2016.

A member of the Aster family (*Asteraceae*), white-haired goldenrod has leaves and stems densely covered with fine, white hairs, a feature that distinguishes it from most other common goldenrods. White-haired goldenrod is restricted to shallow, sandstone cave-like structures called rock-shelters (rockhouses). Rock-shelters are shallow cave-like areas that have been created by under-cutting along a cliff-line. These rock-shelters are common geologic features within the Red River Gorge and are primarily found within areas of Pottsville conglomerate, Breathitt or Lee sandstone. The white-haired goldenrod has a very limited range: it is found only within the Cliff Section of the Cumberland Plateau in Kentucky's Red River Gorge in Menifee, Powell, and Wolfe counties. There are 90 known occurrences containing an estimated 45,000 stems. All 90 occurrences are within the proclamation boundary of the Daniel Boone National Forest (DBNF, however, 21 are on private in-holdings within the forest.

## Literature Cited

U.S. Fish and Wildlife Service. 1988. Endangered and Threatened Wildlife and Plants; Determination of Threatened Status for *Solidago albopilosa* (White-haired Goldenrod). 53 FR 11612-11615.
U.S. Fish and Wildlife Service. 1993. White-Haired Goldenrod (*Solidago albopilosa*) Recovery Plan and Life History. (http://www.fws.gov/endangered/).
U.S. Fish and Wildlife Service. 2009. White-haired goldenrod (*Solidago albopilosa*). 5-Year Review: Summary and Evaluation. Southeast Region, Frankfort Ecological Services Field Office. Frankfort, KY.